BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE MANUAL 11-230
1 MAY 1997

Flying Operations

★ *INSTRUMENT PROCEDURES*

NOTICE: This publication is available digitally on the SAF/AAD WWW site at: http://afpubs.hq.af.mil. If you lack access, contact your Publishing Distribution Office (PDO).

This manual implements AFPD 11-2, *Flight Rules and Procedures*. It provides guidance on establishing, approving, revising, or deleting instrument procedures. It will apply to flying activities at all airfields where the Air Force, or an Air Force component of a unified command conducts or supports instrument flight. Use this manual in conjunction with AFJMAN 11-226, *US Standard for Terminal Instrument Procedures (TERPS)* and NATO APATC-1, *Criteria for the Preparation of Instrument Approach and Departure Procedures*.

Forward copies of all supplements for this manual to the Air Force Flight Standards Agency, Director of Operations, Instrument Procedures (AFFSA/XOIP) for approval. For suggested changes to this manual, use AF Form 847, ***Recommendation for Change of Publication***. Send AF Form 847 through channels to AFFSA/XOIP. AFI 11-215, *Flight Manual Procedures,* will govern processing of AF Forms 847.

SUMMARY OF REVISIONS

This manual replaces AFMAN 13-209, *Instrument Procedures,* which contains numerous additions and revisions.

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Chapter 1

RESPONSIBILITIES

1.1. HQ USAF Responsibilities. HQ USAF/XOO has delegated the approving authority for criteria in AFJMAN 11-226, NATO APATC-1, ICAO PANS-OPS, and this manual to AFFSA/XOIP.

1.2. AFFSA/XOIP Responsibilities:
1.2.1. Approves nonstandard instrument procedures.
1.2.2. Approves standard instrument procedures. HQ AFFSA delegates authorization to major command (MAJCOM) TERPS Function.
1.2.3. Maintains liaison, effects coordination, and serves on committees with other agencies within the US Government, industry, and international civil or military organizations on matters relating to instrument procedure criteria. Represents the US Air Force and Department of Defense (DoD) interest as directed by HQ AFFSA.
1.2.4. Develops proposed criteria as a result of ongoing operational needs, as requested by HQ USAF or MAJCOMs. Tests and evaluates criteria at the direction of HQ USAF.
1.2.5. Custodian for NATO APATC-1.
1.2.6. Approves use of host nation aeronautical information publications for acceptance of host nation instrument procedures.
1.2.7. Manages the Terminal Instrument Procedures Program in support of US Air Force requirements.
1.2.8. Informs the National Imagery and Mapping Agency (NIMA/SMWA) which US Air Force elements may send procedures and revisions for publication.
1.2.9. Develops and maintains agreements with NIMA outlining the data required for publication and maintenance of US Air Force and US Air Force-approved foreign instrument procedures.
1.2.10. Develops and maintains agreements with the Aviation Standards National Field Office of the Federal Aviation Administration (FAA) outlining the processing of US Air Force procedure requirements at US civil and joint-use bases.
1.2.11. Maintains listings of procedural requirements by location, type of procedure, and requiring commands.
1.2.12. Deletes procedures not included on a MAJCOM listing of required procedures after coordination with responsible MAJCOM or agency.
1.2.13. Identifies and justifies deviations to US charting specifications.
1.2.14. Approves computer programs, including micro, used to develop TERPS products and procedures.
NOTE: Programs submitted for approval must include internal and external documentation and the validation of testing routines to ensure there is no violation of TERPS criteria. Submission of flowcharts or program data language (PDL) will enhance validation. Submit requests for copies of approved TERPS programs to your automating agency.

1.3. MAJCOM TERPS Function Responsibilities:
1.3.1. Develops, reviews, approves and submits for publication standard instrument procedures. Approval authority for units minimum vectoring (MVAC) and minimum IFR Altitude Charts (MIFRAC). MAJCOMs may delegate final review and approval authority to group and wing level or combat communications units when required to support unique geographical requirements for short-notice operations. Organizations supporting long-term exercise planning will process procedures according to this manual. When delegating review and approval authority (standard procedures), forward a copy of the correspondence to supporting MAJCOMs and AFFSA/XOIP. All non-standard procedures will be processed IAW this manual. Waiver approval must be obtained from both the host MAJCOM and the deployed units parent MAJCOM.
1.3.2. Provides technical and procedural development assistance when requested by subordinate units. Requests for specific procedure development or verification of TERPS data submitted by subordinate units along with obstruction evaluation cases will be accomplished, when appropriate. The TERPS personnel have the responsibility for ensuring accuracy, adequacy, safety, and practicality of each procedure within their jurisdiction and for developing and providing an effective system of quality control to maintain acceptable standards of performance. They initiate investigative action and ensure remedial action with respect to any deficiency or reported hazard, including restrictions or emergency revisions to procedures. MAJCOM TERPS personnel maintain liaison with their subordinate units, as well as FAA, DoD, and foreign nation personnel (when possible) to ensure consideration of all requirements relating to procedural use of navigational facilities. MAJCOM TERPS offices maintain suitable procedures, with required supporting data, obtaining magnetic variation values used to develop instrument procedures based on navigational aids (NAVAID) and radar facilities flight inspected from FAA/AVN-160.
1.3.2.1. Maintains current listing of all required procedures including location and type of procedure. Provides listing to HQ AFFSA/XOIP by 15 October annually. This Instrument Procedures Listing complies with AFI 37-124, *The Information Collections and Reports Management Program; Controlling Internal, Public and InterAgency Air Force Information Collections.* The Report Control Symbol (RCS) number assigned is RCS: HAF-XO(A)9609, *Instrument Procedures Listing*.

Immediately discontinue reporting this data during emergency conditions. MAJCOM TERPS shall initiate action to have locations and types of procedures that do not appear on this listing, removed from FLIP. Annually review each published and special use instrument procedure. The review should validate the need for each procedure, and ensure that each procedure meets mission requirements.

NOTE: Ensure the procedures meet the requirements for obstacle clearance, navigational guidance, safety, practicality, and conform to current standards on a biennial (every 2 years) basis. Provide AFFSA a listing of procedures with a waiver biannually. Indicate applicable directive and paragraph waived, and expiration date associated with the waiver.

1.3.2.2. MAJCOM TERPS offices shall keep the appropriate FAA Region, Flight Procedures Branch, informed of FAA instrument procedures published in DoD FLIP IAW FAAO 8260.32, paragraph 8b(1).

1.3.2.3. Provide HQ AFFSA/XOIP a copy of all supplements to this manual.

1.3.3. MAJCOM TERPS area of responsibility (AOR) is as follows:

1.3.3.1. Pacific Air Forces (PACAF) supports Pacific Command and other USAF procedure requirements in the Alaska; Pacific, Australasia, and Antarctica; and Eastern Europe and Asia FLIP (East of the 88 degrees longitude line). The PACAF AOR includes India, Pakistan and Afghanistan.

1.3.3.2. United States Air Forces Europe (USAFE) Air Operations Squadron (AOS) supports USAF requirements in the Europe, Africa, and Middle East, and the Eastern Europe and Asia (West of the 88 degrees longitude line), FLIPs.

1.3.3.3. Air Mobility Command (AMC) has delegated the 640 AMSS/TERPS, Howard AB, Panama, MAJCOM responsibilities for the Caribbean, Central and South American region.

1.3.3.4. Air Education and Training Command (AETC) supports Canada and North Atlantic FLIP, and Air Force Space Command.

1.3.3.5. Air Combat Command (ACC), Air Mobility Command (AMC), and Air Force Materiel Command (AFMC) are responsible for their respective command elements.

1.3.3.6. Air National Guard (ANG) TERPS office supports all bases where they maintain an air traffic control function. They will also maintain ANG procedures required at civil airports developed IAW FAAO 8260.32, on a case by case basis.

1.3.3.7. Air Force Reserve (AFRES) supports all Air Reserve Bases/Stations and AFRES procedures required at civil airports developed IAW FAAO 8260.32, on a case by case basis.

NOTE: Gaining/Supporting MAJCOMs of ANG and/or AFRES assets may be tasked to support the TERPS requirements of the mission in cases where the ANG/AFRES TERPS offices are not capable of support.

1.4. MAJCOM or Air Force Component of a Unified Command Director of Operations Responsibilities:

1.4.1. Ensures operational expertise is available to assist TERPS personnel in developing, reviewing/validating, and revising procedures. During contingency operations, the Air Force component commander may request the establishment of an in-theater TERPS cell for the purpose of developing and approving instrument procedures.

1.4.2. Ensure flyability check is performed for procedures to be published in the DoD FLIP.

1.4.3. Ensures each procedure or revision is operationally acceptable for the command or unit mission. In making this determination, considerations are:

1.4.3.1. Past, current, and intended usage by type of aircraft.

1.4.3.2. Climatology and topography affecting the terminal area.

1.4.3.3. Whether the procedure is a special, restricted, or public use procedure.

1.4.3.4. Flight inspection of the procedure by a US agency or host country flight inspecting to US or ICAO Annex 10 standards.

1.4.3.5. Validation of the procedure by a US agency for other US users.

1.4.3.6. The nature of the deviations that make the procedure nonstandard.

1.4.4. Approves special-use procedures. A special-use procedure is one not published in the FLIP (Terminal), normally published loose-leaf and for which an operational requirement exists (see paragraph 2.1.2). The MAJCOM having jurisdiction over the participating aircraft approves the use of these procedures. Procedures approved under this paragraph must state; "For Use by (organization/exercise) ACFT Only," and requires review by an Air Force TERPS servicing agency. Procedures not meeting applicable TERPS criteria (non-standard procedure) must be coordinated with HQ AFFSA/XOIP (see paragraph 2.5).

1.4.5. Ensures civil engineering or other appropriate agencies provide obstacle and airfield engineering data to support the development and maintenance of required procedures. Engineering maps from the Base Comprehensive Plan are an example of these data. Unit TERPS offices will require current C-1, C-2, E-1, E-2, and E-3 engineering maps. Other engineering maps are optional. AFI 32-7062, *Air Force Comprehensive Planning*, provides engineering map guidance.

1.5. Unit TERPS Responsibilities:

1.5.1. Initiates actions essential to the fulfillment of TERPS program objectives assigned by their parent MAJCOM TERPS office and appropriate directives.

NOTE: Situations may occasionally require extension beyond written and specific terms of a directive. Where safety or practicality of air navigation is a factor, the TERPS specialist cognizant of the situation will take action to change the situation.

1.5.2. Using the most accurate information available; plots, verifies and updates computerized obstruction and airfield data from maps, civil engineering maps, charts, surveys, and computer data bases. Maintains master obstruction maps (See paragraph 4.2.2).

1.5.3. Prepare automated (manual when applicable) instrument procedure packages for approaches, departures, and Standard Terminal Arrival Routes to meet mission needs (See paragraph 4.2.3, *Reviewing and processing Automated Procedure Packages)*. Prepare Diverse Departure computations, Minimum Vectoring Altitude Charts (MVAC),and Minimum IFR Altitude Charts (MIFRAC). ***NOTE:*** When obstacles are added/deleted from the TERPS data base, all instrument procedures, including Diverse Departure, MVAC, MIFRAC, and MSAW/LAAS operations, must be re-evaluated.

1.5.3.1. Coordinate new and revised instrument procedures with appropriate agencies.

1.5.3.2. Notify the MAJCOM TERPS office whenever your location/obstacle data base has been modified.

1.5.4. Maintain TERPS Publications IAW Attachment 1 and TERPS files IAW USAF, MAJCOM, and base directives.

1.5.4.1. Develop and maintain a continuity folder including, as a minimum (See MAJCOM supplement, if applicable), the following:

1.5.4.1.1. Key Personnel.

1.5.4.1.2. Projects in Progress.

1.5.4.1.3. Procedures Listing.

1.5.4.1.4. TERPS Equipment Listing.

1.5.4.1.5. Listing of Local References (Wing Regulation, etc.).

1.5.4.1.6. File Maintenance and Disposition Plan.

1.5.4.1.7. FLIP Cycle Review Log.

1.5.4.1.8. Annual Validation and Procedure Amendment Log.

1.5.4.1.9. Copy of completed Annual/Semiannual Self Inspection ATSEP Checklist (See AFI 13-218, ***Air Traffic System Evaluation Program*** for checklist).

1.5.4.2. TERPS files will contain current C-1, C-2, E-1, E-2, and E-3 Comprehensive Plan maps. Other maps are optional. ***NOTE:*** AFI 32-7062, ***Air Force Comprehensive Planning***, provides Comprehensive Plan map guidance.

1.5.5. Conduct annual review of instrument procedures and provide written correspondence to parent MAJCOM NLT 15 September. The review should validate the need for each procedure, and ensure that each procedure meets mission requirements.

1.5.6. Conduct a biennial (Every 2 years) review to include the following:

1.5.6.1. Obstacle data base. ***NOTE:*** Obstacle data bases shall be updated and documented as changes occur (i.e., map revisions, CHUM changes, etc.). Evaluate vegetation growth and new/proposed construction (The purpose of this evaluation is to ensure that vegetation growth was considered and review all updates made over the past two years).

1.5.6.2. Review/validate need for existing waivers and ensure currency (if applicable).

1.5.6.3. Review MVAC, MIFRAC, Diverse Departure/Diverse Vector Areas, IAPs, STARs, and SIDs to ensure development complies current standards and correct obstacle assessments have been applied.

1.5.6.4. This review will be documented and a copy forwarded to parent MAJCOM NLT 15 Sept. in the applicable year.

1.5.7. Complete FAA Form 8240-22, ***Facility Data Sheet,*** IAW FAAO 8240.36, *Instructions for Flight Inspection Reporting*.

1.5.8. Prepare FAA Form 6050-4, ***Expanded Service Volume Request,*** as required.

1.5.9. Review and document that procedural data in each new FLIP product is correct (See Para. 2.8.1).

1.5.10. Provide notification of instrument procedure revisions to wing civil engineering and airspace management to ensure compatibility with the Air Installation Compatible Use Zone (AICUZ). Provides information to the CATCT/CSE for controller training and ready-reference file update.

1.5.11. Review and comment on FAA Form 7460-1, ***FAA Notices of Proposed Construction or Alteration***, for affects on instrument procedures, MVAC, MIFRAC, and MSAW (See Attachment 6, paragraph A6.6).

1.5.12. Accomplish and submit a Request for Environmental Impact Analysis, if required, IAW AFI 32-7061, *Environmental Impact Analysis Process,* in conjunction with each new, or revised instrument procedures.

1.5.13. Ensure instrument procedures data requiring NOTAM action is provided to Airfield Management.

1.5.14. Assist Facility Chief Controller in development of Video Mapping, and Programmable Indicator Data Processor (PIDP) submissions.

1.5.15. Attend Base Airfield Operations Board meetings.

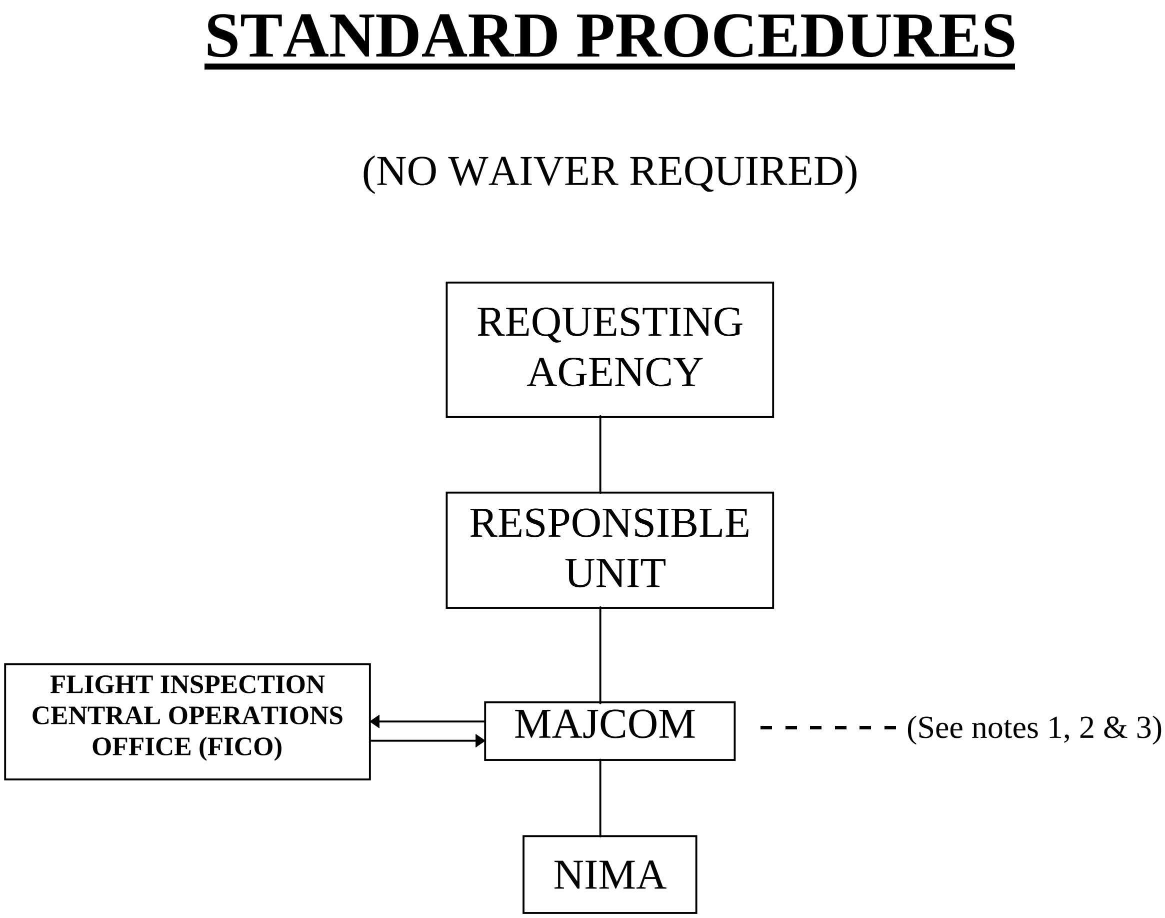
Chapter 2

HOW TO PROCESS, PUBLISH, REVISE, AND DELETE INSTRUMENT PROCEDURES

2.1. Steps in Processing and Publishing Instrument Procedures (figures 2.1 and 2.2)**:**
2.1.1. **Requesting Agency (i.e., MAJCOM, Air Force Component of a Unified Command or Unit Flying Organization):**
2.1.1.1. Identifies requirement for new or revised procedure and advises the responsible agency for that location. Requests must contain:
2.1.1.1.1. Name of the airfield or location desired.
2.1.1.1.2. Type of procedure, for example, High or Low Altitude, Very High Frequency Omni-Directional Range (VOR), Instrument Landing System (ILS), Tactical Air Navigation (TACAN).
2.1.1.1.3. Approach categories.
2.1.1.1.4. Special requirements. Detail specific features or capabilities needed, for example, point to which a departure procedure should go, en route fixes where the recovery or approach should commence, and avionics features that influence procedure design.
2.1.1.1.5. Date procedure or revision must be available, when appropriate, date no longer needed.
2.1.1.1.6. Designation and address of organizations or units requesting the procedure and number of copies required, when NIMA publishes in loose-leaf format.
2.1.1.1.7. Runway number(s) of procedure. For foreign procedures, include a copy of the host nation procedure, if possible.
2.1.1.2. May recommend, with justification, a procedure for inclusion in the appropriate DoD FLIP. Evaluate on a case-by case basis a need to publish procedures at alternate airports or airports not frequently used. Send specific justification to the MAJCOM headquarters.
2.1.1.3. May request new or revised instrument approach or departure procedures at domestic civil airports or USAF air bases where FAA provides TERPS service in accordance with FAA Order 8260.32.
2.1.1.4. Forward publication requests for civil procedures to the proper MAJCOM TERPS office. Base requests for publication of civil approaches in DoD FLIP on operational requirements.
2.1.2. All instrument procedures will be published and distributed by NIMA, except if a unique situation exists where there is an urgent need (due to war time/contingency operations, etc.) for the procedure and NIMA cannot support the requirement. MAJCOMs may then locally publish these procedures until receipt of the NIMA product (See *NOTE 2)*. MAJCOMs shall send HQ AFFSA/XOI information copies of the locally published product with the applicable page one of AF Form 3637, ***Instrument Approach Procedures,*** and/or AF Form 3634, ***Departure Route/Standard Instrument Departure (SID),*** immediately upon completion. Locally published instrument procedures shall conform to IACC specifications to the maximum extent possible, contain an expiration date, a point of contact, and, if applicable, exercise name and authorized users.
NOTE 1: If a procedure is in the developmental phase, a MAJCOM/unit may produce a product for review and/or coordination purposes, and a caveat must be placed in the Plan View stating: NOT FOR NAVIGATIONAL USE or FOR USE BY FLYABILITY/FLIGHT CHECK AIRCREW ONLY.
NOTE 2: When the procedure requirement is of short duration, time will not permit production of a product by NIMA, and it can only be published locally, the procedure does not have to be sent to NIMA.
2.1.3. Publication of Radar procedures:
2.1.3.1. Airborne Radar Approaches (ARAs) shall be published in a graphic format (Plan and Profile View).
2.1.3.2. PAR/ASR approaches are published in text format in Terminal FLIP products in the section identified as: RADAR INSTRUMENT APPROACH MINIMUMS. However, there may be situations where the PAR/ASR procedure is complex or in an obstacle rich environment, etc., which could justify publication in the graphic format also. NIMA specifications exist to permit this type of portrayal.

2.2. The MAJCOM TERPS Function:
2.2.1. Selects an existing US Government/foreign nation procedure or develops a new procedure for publication.
2.2.2. At foreign locations, where a US Government agency is not responsible for air traffic control, selects instrument procedures to satisfy requirements if:
2.2.2.1. The procedure is in an international AIP or acquired as the result of an agreement.
2.2.2.2. An international aeronautical information service is available for the procedure.
2.2.2.3. The procedure can be safely flown, as depicted or explained, using US Air Force instrument flight procedures contained in AFMAN 11-217, *Instrument Flight Procedures*, and other applicable directives.

Figure 2.1. Processing Standard Instrument Procedures.



NOTES:

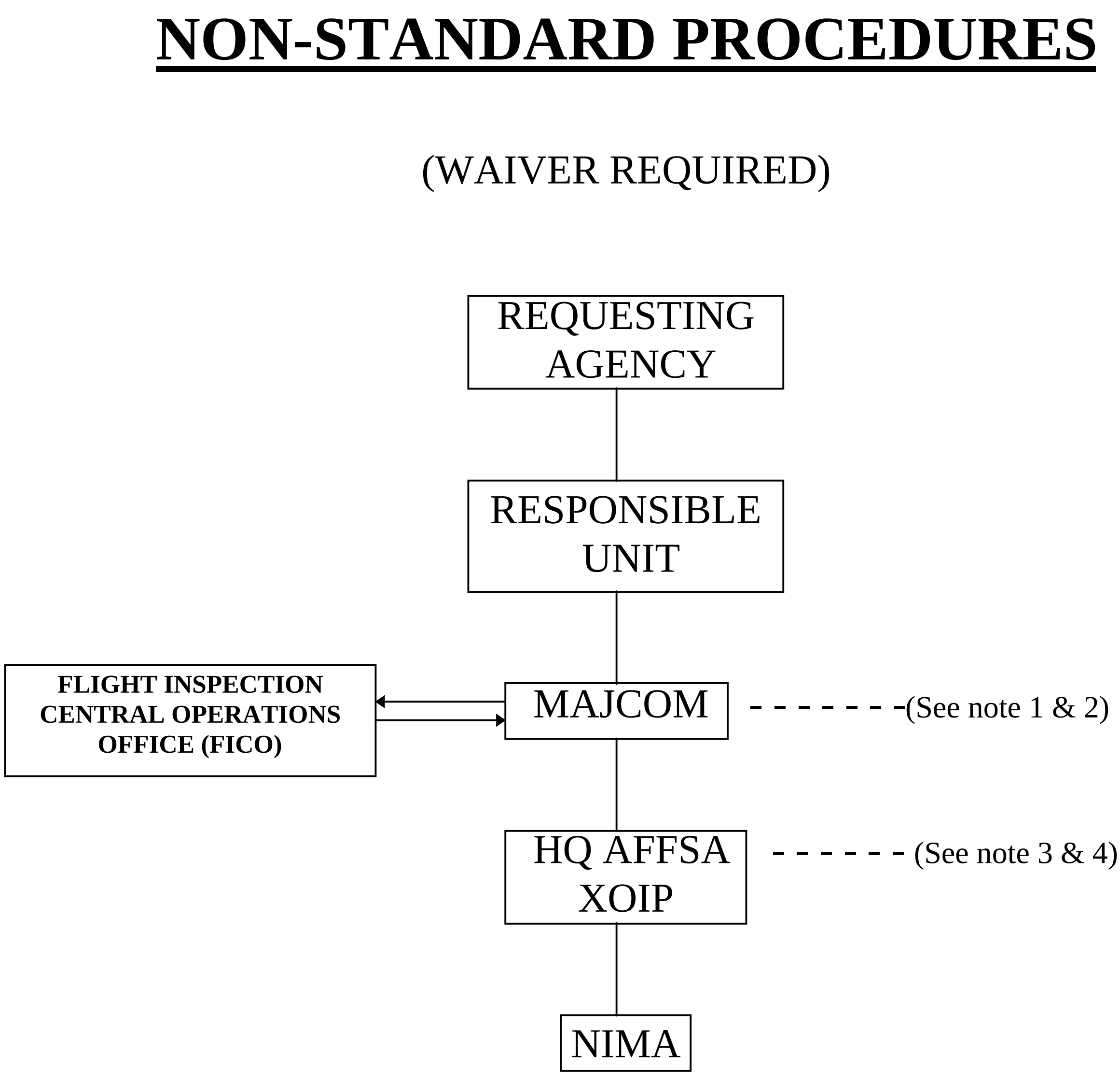
1. Locations where USAF OSS are not available to develop and locally coordinate procedures, development and local coordination will be performed by the applicable MAJCOM or independent group as directed by HQ AFFSA/XOIP.

2. When final review and approval authority is delegated below the MAJCOM, the approving unit will send the approved procedures to NIMA for publication and a copy to the responsible MAJCOM.

3. After the MAJCOM has reviewed the procedure, it must be forwarded to the Flight Inspection Central Operations Office (FICO) for flight inspection services (See FAAO 8240.32). The Flight Inspection Office (FIO) conducting the flight inspection will return the signed package to the MAJCOM.

2.2.3. Coordinates with a foreign nation:
2.2.3.1. For approval of a new procedure if a suitable one is not available.
2.2.3.2. When altering an existing procedure, except with higher minima, emergency safe altitudes, minimum safe altitudes, or other changes permitted by an established agreement with the host nation.
2.2.4. Coordinates with the requesting agency and appropriate air traffic units, as required.
2.2.5. Reviews and approves unit developed TERPS procedures. Ensures official flight inspection is requested only after procedure approval. Ensures all data required by AFJMAN 11-225, Section 214, is submitted to flight inspectors prior to flight check operations. When authorized submit all new standard or special instrument procedures, civil or host nation procedures, procedural changes (fix, course, altitude, published minimum, obstacle data, and procedure identification) to existing procedures to NIMA/SMWA. Submit nonprocedural changes and recommendations for improvement of FLIP product content/format IAW *DoD FLIP General Planning*, chapter 11.

Figure 2.2. Processing Nonstandard Instrument Procedures.



NOTES:

1. Locations where USAF OSS are not available to develop and locally coordinate procedures, development and local coordination will be performed by the applicable MAJCOM or independent group as directed by HQ AFFSA/XOIP.

2. After the MAJCOM has reviewed the procedure, it must be forwarded to the Flight Inspection Central Operations Office (FICO) for flight inspection services (See FAAO 8240.32). The Flight Inspection Office (FIO) conducting the flight inspection will return the signed package to the MAJCOM.

3. HQ AFFSA is the final approving authority before publication. All items/approval signatures must be completed before submitting to HQ AFFSA, including flyability check and flight inspection.

4. HQ AFFSA/XOIP will advise MAJCOMs of waiver approval or disapproval using AF Form 3980, ***Instrument Procedure Waiver.***

2.2.6. Processes procedures and supporting documentation as shown in Figure 2.1 or Figure 2.2.
2.2.7. Shall not change procedure identification. If the identification differs from AFJMAN 11-226 criteria, explain the intent of the procedure, (the foreign nation identifies a procedure as "TACAN/ILS R-35" that provides ILS final approach guidance only). In such cases, annotate the procedures in the minima block: "S-TAC-35 NOT AUTHORIZED." Draw

initial submissions of foreign nation procedures. Do not use cut-out/paste-on of foreign nation procedures on the AF Form 3637, ***Instrument Approach Procedures***; however, once DoD FLIP publishes the procedures, cut-out and paste-on are acceptable.
2.2.8. Plan the operational date for new procedures to coincide with the FLIP General Planning (GP), chapter 11, *Revision Schedules*. When this is not possible, publish the procedure with a caveat "Effective by NOTAM." Do not use this caveat for more than 90 days (AFJMAN 11-208, *The US Military Notice to Airmen [NOTAM]*).
2.2.9. Provide written guidance to subordinate units on steps required for processing procedures.

2.3. Unit TERPS:
2.3.1. Provide sufficient information to permit a rapid and complete check of the procedure package by the designated agencies. Submit request for new procedures predicated on a programmed NAVAID or runway at least six months prior to the estimated commissioning of the new NAVAID or runway (***NOTE:*** The flyability check and FAA flight check requirement will be completed simultaneously during the commissioning flight inspection.). New procedures will be published in the DoD FLIP with an "EFFECTIVE BY NOTAM" caveat. A NOTAM of procedure availability will be issued immediately following successful flight inspection to include any required changes. Legible copies may serve as originals in a TERPS package. (See attachment 4 for specific contents needed for each reviewing agency.)
2.3.2. Includes the following documents/information in a procedure package:
2.3.2.1. Signed copies of:
2.3.2.1.1. AF Form 3637, ***Instrument Approach Procedures***.
2.3.2.1.2. AF Form 3632, ***Minimum Vectoring Altitude Chart (MVAC)***.
2.3.2.1.3. AF Form 3634, ***Departure Route/Standard Instrument Departure (SID)***.
2.3.2.1.4. AF Form 3636, ***Application of Diverse Departure Criteria***.
2.3.2.2. Computation sheets, when used, (AF Form 3635, ***Application of Departure Route Criteria***; AF Form 3639, ***Precision Computations***; AF Form 3640, ***Nonprecision Computations***; AF Form 3641, ***VDP Computations Worksheet***; and AF Form 3642, ***Circling Computations***, showing DH/MDA/CMDA, HAT/HAA, visibility and ceiling values, etc.) will be attached to the procedure package. Do not send computation sheets to NIMA. Include notation on the forms when sources of obstacle data, computed values, and nonstandard criteria can cause misunderstanding by reviewing levels. Computer printouts will replace computation forms when developed by automation.
NOTE: Annotate on AF Form 3639 the type of radar used for PAR approach procedure development. Change procedures associated with a GPN-22 or TPN-19, the Block 2, touchdown (TD) reflector distance, to "TD DISTANCE" and annotated with the TD distance derived from the radar's site parameter panel TD distance setting. For new or revised ILS installations, select use of rapidly dropping or smooth terrain formulas, based on the same criteria used by the installation engineer.
2.3.2.3. Charts, maps, or automation overlays showing proper segments and holding patterns of the complete procedure as defined in AFJMAN 11-226. Ensure the charts and maps are available to all users when using overlays (see note 1). Process requests for charts according to instructions in the *DoD Catalog of Aeronautical Charts*, FLIPs.
NOTES:
1. When preparing overlays for FAA flight inspection (See FAAO 8200.1, Section 214), place the overlays on the map, photocopy, and highlight the controlling obstacles in each segment. The overlay also may be placed on an original map/chart and traced using a light table. Controlling obstacles must also be highlighted when using an original map. FAAO 8260.19, ***Flight Procedures and Airspace***, defines the preferred map/chart as the local 1:500,000 series Sectional Aeronautical Chart, published by National Ocean Service, or the National Topographic 1:250,000 series map, published by U.S. Geological Survey. NOAA 1:250,000 VFR Terminal Area Charts may also be used when available.
2. Units with a DoD Activity Address Code (DODAAC) shall have all maps/charts applicable for their location listed for Automatic Initial Distribution (AID). This will ensure automatic receipt of any map/chart revisions. Units without a DODAAC should have their AID requirements specified on the Base Operations DODAAC.
2.3.2.4. Supporting documentation which affected the planning of the procedure (engineering surveys, foreign nation Aeronautical Information Publication (AIP), NAVAID or airspace limitations, flight inspection results, etc.). Submit requests for Expanded Service Volume (ESV), FAA Form 6050-4, ***Expanded Service Volume Request*** (attachment 5), when instrument procedures require use of NAVAIDs beyond their usable distance and altitude limitations as listed in FAAH 7110.65, ***Air Traffic Control***. Request ESV check according to instructions in attachment 5 and include supporting documentation in the procedure package.
2.3.2.5. The location, type, and height of the controlling obstruction in each segment of the procedure. When reliable charts and obstacle data are unobtainable, assume the most critical evaluation of the obstacle locations (identify source of assumed values, state forestry department, etc.). Accomplish this by plotting the obstacle location and height from various sources and using the placement and/or value that requires the highest minima.
2.3.2.6. Automated procedures packages must contain the complete printout of the building process (printer must be turned on for the entire "build" process).
2.3.2.7. Automated procedure packages must be reviewed and processed IAW paragraph 4.2.3.

2.3.3. Include in loose-leaf packages the same information as prescribed in paragraph 2.3.2. Submit requests to the MAJCOM TERPS Office and include a list of all the addressees and the number of copies sent to each (Include DoD Activity Address Code {DODACC} of recipients). Include three copies for forwarding to AFFSA/OL-D, and one copy to AFFSA/XOIP.
2.3.4. Provide the technical expertise and procedure alternatives necessary to help in the drafting of the waiver justification. Address each nonstandard condition independently on AF Form 3980, ***Instrument Procedure Waiver***. Process procedures needing waivers independently of all other procedures with no reference to other procedures for substantiation (waiver request for violation of AFJMAN 11-226, for ILS RWY 36, LOC RWY 36, TACAN RWY 36 and specify any other affected approaches to Runway 36 if they require waiver approval.). Complete documentation and supporting data shall accompany the waiver request so reviewing offices can conduct an evaluation without additional research. The fact that a procedure has existed for a number of years does not provide an equivalent level of safety.
NOTE: MAJCOMs will send a copy of the waiver package to AFFSA/XOIP and maintain the original package until receipt of approval/disapproval notice. Then return the approval/disapproval notice and original package to the requesting unit.

2.4. The MAJCOM Headquarters Director of Operations:
2.4.1. Evaluates and endorses each nonstandard procedure.
2.4.1.1. Concurs or non-concurs with the request for inclusion in the recommended DoD FLIP.
2.4.2. Ensures a flyability check is performed.

2.5. Non-Standard Procedure Waiver Requests.
2.5.1. Submit a waiver request using AF Form 3980, ***Instrument Procedure Waiver***. Units will provide the original plus two copies of the procedure package to the MAJCOM. MAJCOM will submit one copy of the procedure package to HQ AFFSA/XOIP. See Attachment 4 for package contents. See figure 2.1 for processing guidance. Contingency or short notice exercises may be coordinated telephonically or facsimile. The request must also contain:
2.5.1.1. A statement of flyability check completion (See paragraph 3.13 and Attachment 9).
2.5.1.2. Appropriate AIP information for a foreign procedure and/or information obtained by agreement from host nation.
NOTE: When a procedure is amended, reprocessing of an existing waiver is not necessary unless the amendment directly impacted the basis for the waiver.
2.5.2. A Permanent Waiver will not normally be granted. Waivers will normally be valid for Two Years from the date of issue and must be resubmitted NLT 45 days prior to expiration. Re-validation requests require a letter stating the following:
2.5.2.1. Justification for continued use of procedure.
2.5.2.2. Operational impact if not re-validated.
2.5.2.3. Copy of previous approval message/letter or AF Form 3980, ***Instrument Procedure Waiver.***
2.5.2.4. Any additional information deemed appropriate.

2.6. Acceptance of Foreign Terminal Instrument Procedures. The following guidelines shall be used for publication and/or use of instrument procedures outside U.S. jurisdiction. A process called the Host Nation Acceptance Program has been established to assist TERPS Specialists in the review/publication process. This program validates the reliability and accuracy of select host nations instrument procedure development and publication practices. Host nations meeting the strict guidelines set forth are allowed publication and/or use after applying paragraphs 2.6.1 through 2.6.6, as applicable. The checklist at Attachment 7 is used to determine the level of acceptance to be applied to each host nation being considered.
2.6.1. FAA specifies restrictions to specific foreign instrument procedures that may be used by US civil air carriers in FAA Order 8260.31, *Foreign Terminal Instrument Procedures*. The USAF will comply with all of these restrictions. Those procedures specified in FAAO 8260.31 are suitable for publication in the DoD FLIP providing:
2.6.1.1. FAA verifies the procedures are still acceptable.
2.6.1.2. Restrictions in FAAO 8260.31 are applied to the USAF procedures.
2.6.1.3. Procedures are reviewed (see attachments 7 and 8).
2.6.1.4. Procedures are flyability checked (see paragraph 3.13 and attachment 9).
NOTE: FAA Order 8260.31 also maintains a list of nations whose FTIP are not authorized for use by U.S. certificate holders. The MAJCOM Director of Operations, in whose theater of operations these nations lie, may approve operations and use of FTIP in these countries based on the most current data (i.e., Navaid reliability, intelligence data, etc.) available and mission requirements. Procedures must still be reviewed IAW paragraphs 2.6.1.3 and 2.6.1.4.
NOTE: If the FAA reinitiates its list of pre-approved foreign AIPs, AFFSA/XOIP will obtain copies and disseminate to the MAJCOM TERPS offices.
2.6.2. The MAJCOM will accomplish the following when applying the Host Nation Acceptance Program:
2.6.2.1. Inform AFFSA/XOIP as early as possible that a host nation AIP is being considered for acceptance. AFFSA/XOIP, in turn, will request comments from USAASA, NAVFIG, and FAA.

2.6.2.2. Notify AFFSA/XOIP of all known host (civil and/or military) declared exceptions to U.S. TERPS/PANS-OPS/APATC-1. AFFSA/XOIP will be the final approval authority for USAF acceptance of exceptions.
2.6.2.3. Identify and notify HQ AFFSA/XOIP of the host nations that have an acceptable instrument procedure publication that may be used by aircrews without the need for a MAJCOM TERPS review. NOTE: Host nation instrument procedure development practices must be in ***strict compliance*** with requirements set forth in Attachment 7 in order to allow this exception.
2.6.2.4. Conduct procedure evaluation using checklist at attachment 8.
2.6.2.5. Ensure a “live” flyability check is performed. ***NOTE:*** See paragraph 3.13.1.4 Notes 2 and 3.
2.6.2.6. Send AFFSA/XOIP a copy of completed AIP acceptance documentation. ***NOTE:*** Checklist at attachment 7 must accompany this documentation.
2.6.2.7. Send AFFSA/XOIP courtesy copies of all procedure packages (sent to NIMA) predicated on the USAF host nation acceptance process. ***NOTE:*** A procedure package will consist of a cover letter with appropriate instructions to NIMA and the appropriate AF Form, i.e., AF Form 3637, AF Form 3634, etc.
2.6.3. AFFSA/XOIP will accomplish the following when responding to the Host Nation Acceptance Program:
2.6.3.1. Maintain a list of USAF accepted AIPs (distinguishing whether civil or military) and instrument procedures, and inform the NAVFIG, USAASA, and FAA of completed USAF host nation acceptance actions.
2.6.3.2. Notify MAJCOMs whenever FAA changes the status of approved host AIPs and IAPs.
2.6.4. The following general guidelines will apply to host nation instrument procedures subjected to the AIP and instrument procedures checklists:
2.6.4.1. Do not alter host nation procedure titles.
2.6.4.2. Publish host nation warnings and/or cautionary notes.
2.6.4.3. Publish host nation procedural restrictions.
2.6.4.4. Establish minimum sector altitudes not lower than altitudes specified by the host nation. Addition of an emergency safe altitude requires prior approval from the host nation.
2.6.4.5. Identify all IAFs.
2.6.4.6. State host nation published alternate minimums verbatim unless the DoD procedure is "NOT FOR CIVIL USE." In those cases, do not publish alternate minimums.
2.6.4.7. Include host nation feeder routes and associated data/altitudes on the DoD procedure. Addition of a route requires host nation approval, as does establishing a minimum flight altitude.
2.6.4.8. Publish a caution note on the DoD procedure anytime it exceeds US TERPS descent gradient limits.
2.6.4.9. Publish host nation circling restrictions on DoD procedures.
2.6.4.10. Add VDPs only if specifically requested by the proponent and the host approves.
2.6.4.11. Convert and publish host nation "percentile" climb gradients in FPNM.
2.6.4.12. Use AFJMAN 11-226, chapter 3, to validate minima. Publish the higher of resultant computations or the host's values. The following exceptions apply:
2.6.4.12.1. If TDZE is not available, use threshold elevation for the HAT.
2.6.4.12.2. If threshold elevation is not available, use airport elevation for the HAT.
2.6.4.12.3. Use airport reference elevation when the touchdown zone, threshold, or airport elevation are not available.
2.6.4.12.4. Publish a note anytime HAT/HAA figures are not according to normal US TERPS factors.
2.6.4.12.5. **Paragraph 332.** In the absence of data to verify there are no penetrations to the 20:1 and/or 34:1 surfaces, the 1 mile and/or 3/4 mile restrictions need not apply if other factors reasonably assure that lower visibility is safe. Exercise sound judgment at all times. Use all information available, including input from the flyability check.
2.6.4.12.6. **Paragraph 334a.** Does not apply.
2.6.4.12.7. **Paragraph 334b.** Does not apply.
2.6.4.12.8. **Paragraph 342.** If runway markings and/or course alignment are questionable, inform the flyability check pilot and request particular attention to those aspects of the procedure.
2.6.4.12.9. **Paragraph 360.** Does not apply.
2.6.4.12.10. A maximum holding airspeed shall be defined in the planview for all host nation procedures that have a holding pattern established. ***NOTE:*** This may require contacting the host nation to make this determination if the maximum holding airspeed is not published on their procedure or identified elsewhere in the AIP.
2.6.5. **RESERVED**
2.6.6. **Aircrew Use of Foreign Instrument Procedures Not Published In U.S. Government (DoD or NOAA/NOS) FLIP.** AFI 11-206, *General Flight Rules*, Chapter 8, says MAJCOM TERPS offices must review procedures not published in a DoD or NOAA FLIP for which an operational requirement exists. The MAJCOM responsible for the area in which the airport (procedures) is located will conduct these reviews. If another MAJCOM requiring a procedure review requests review responsibility, it may be delegated to them.
2.6.6.1. A review request should be received by the MAJCOM TERPS office at least 5 duty days prior to date of anticipated use. The request shall consist of:

2.6.6.1.1. Four-letter ICAO location identifier.
2.6.6.1.2. Name of airport.
2.6.6.1.3. Name of procedure to be reviewed.
2.6.6.1.4. Identify product to be used (host nation FLIP product, host nation AIP, Jeppesen, etc.) indicating specific volume, section, page number, and date.
2.6.6.1.5. Aircraft category(s) and aircraft instrument capability (e.g., NDB, VOR, TACAN, GPS).
NOTE: If a specific procedure is not identified, the reviewing agency shall select one approach to each runway that provides the lowest minima (no lower than Cat I ILS).
2.6.6.2. The extent of the review is as follows:
2.6.6.2.1. If the airport is located in a country identified on the HQ AFFSA Host Nation Acceptance List, the product to be used must be reviewed using the Attachment 8 checklist. Additionally, if a commercial product (e.g., Jeppesen, etc.) will be used, a comparison review to the host-produced FLIP/AIP product must also be accomplished.
2.6.6.2.2. If the airport is located in a country *not* identified on the HQ AFFSA Host Nation Acceptance List, a complete TERPS evaluation (either manual or automated) of all segments (including holding) and minima must be accomplished. The MSA must also be evaluated. NOTE: It is not necessary to develop a Master Obstruction Chart (MOC) covering a 105 NM radius for this type of review. If a "segment review" method is used (without a MOC developed), care must be taken to ensure terrain lines and obstacles on the border of the trapezoids are considered.

- It is not necessary to develop a Master Obstruction Chart (MOC) covering a 105 NM radius for this type of review. If a "segment review" method is used (without a MOC developed), care must be taken to ensure terrain lines and obstacles on the border of the trapezoids are considered.
- Use 1:24,000, 1:25,000, 1:50,000, 1:62,000 maps to conduct reviews inside 10 NM. Inside or outside 10 NM, if the maps are limited or non-existent, use the best material available for that area (i.e., DVOF, DAFIF, 1:250,000 Map, etc.).

2.6.6.3. HQ AFFSA will maintain a list of reviewed procedures using the File Transfer Protocol (FTP) server, listing results of reviews conducted IAW paragraphs 2.6.6.2.1, and 2.6.6.2.2 above. This list will be updated by the MAJCOM conducting the review. NOTE: For a procedure to be placed on this list from a country/airport not on the HQ AFFSA Host Nation Acceptance List, a complete TERPS evaluation must have been completed IAW paragraph 2.6.6.2.2.
2.6.6.4. The reviewing MAJCOM TERPS office will be responsible for informing the requester's MAJCOM TERPS office and/or MAJCOM flying operations office of the results of the procedure review. **NOTE: Authorization to use the procedure(s) ultimately remains with the appropriate MAJCOM flying operations authority.**
2.6.6.5. If the procedure will support a permanent or extended temporary (special operation or exercise) requirement, and will receive continuous maintenance until published or no longer required, MAJCOM approval authority may extend up to publication in appropriate FLIP. An expiration or anticipated publication date shall be specified. The MAJCOM conducting the review shall be responsible for currency and informing the requester of any changes. NOTE: If subsequent/additional requests for a procedure review is received and maintenance has been continuous, the procedure does not have to be reviewed again from the beginning. For example: if a procedure will be required for an extended period of time or is awaiting publication, and request(s) come in for a review, the process ***does not*** have to be re-initiated each time. If the procedure is in another MAJCOM's AOR, the reviewing MAJCOM retains maintenance responsibility until the operation/exercise expires or maintenance responsibility is transferred. If maintenance of the procedure is stopped, for whatever reason, and a new request for use of the procedure is submitted, the review must be re-accomplished.
2.6.6.6. If more than three reviews over a 12 month period of the same location are required, the responsible MAJCOM (within whose AOR the location lies) should take steps to publish the procedures in DoD FLIP, IAW paragraph 2.1 (Countries NOT on HQ AFFSA Host Nation Acceptance List) or paragraph 2.6.1 (Countries on the HQ AFFSA Host Nation Acceptance List).

2.7. Revising Instrument Procedures:
2.7.1. Procedural changes are those changes affecting fix, radial, bearing, course, track, altitude, minima, obstacles, procedure identification, and operational notes/remarks. Process procedural changes through the appropriate channels shown in figure 2.1 or 2.2.
2.7.2. Submit all other non-procedural changes according to FLIP GP, chapter 11. Non-procedural revisions should contain enough information to allow page changes to the approved procedure package on file. Non-procedural changes do not require processing through original coordinating channels; however, send an information copy to the MAJCOM TERPS office.
2.7.3. Amendment System. The TERPS specialists will assign and control amendment numbers for each procedural change. Use no more than three procedural/amendment changes. **NOTE:** Use "Original" signature sheet for the three amendments. Procedural changes after the Third amendment requires the procedure package be re-automated and designated original. All correspondence for processing the procedure will reference the current amendment number. Depict the amendment number on the published IAP and will be used by the flight check pilot to confirm currency of obstacle information.
2.7.4. Manual Procedure Revision(s):
2.7.4.1. Revisions shall not make procedure packages illegible or difficult to review.

2.7.4.2. Revisions which are not developed using automation software must describe how the change was verified for compliance with AFJMAN 11-226. Restrict each procedure to a maximum of three (3) non-automated revision submittals (pen and ink changes are acceptable). Forward the procedure package with a coordination letter describing the change and compliance with applicable instructions to each agency (See Figure 2.1 or 2.2), which coordinated on the original, for their endorsement. Maintain the letters in the procedure package until all signatures are obtained and the pertinent information added to Block 31 of AF Form 3637. Completely redevelop the procedure using automation or manual methods after the third revision.

NOTE: MAJCOM approval responsibility for revisions is the same as for original packages. All approval signatures must be re-obtained. MAJCOMs are the final authority guaranteeing AFJMAN 11-226 criteria compliance.

2.7.5. Automated Procedure Revision(s):

2.7.5.1. May be revised by either re-automating the entire procedure or manually calculating the impact of minor changes.

2.7.5.2. In either case use a new AF Form 3637. The remarks section on AF Form 3637 (Block 31) must contain sufficient information that the reason for the procedural revision will be clear to the reviewing offices. Include in the remarks section why the procedure was not re-automated, if applicable. Forward all recommendations for procedural revision to TERPS products through organizational channels to appropriate MAJCOM. Coordinate revisions through each agency which coordinated on the original procedure (See Figure 2.1 or 2.2). Re-accomplish coordination when changing terminal airspace actions (for example, holding pattern size) to instrument procedures.

NOTE: When using a notice to airmen (NOTAM) or message to make a procedural change, forward a new or revised package within 30 working days.

2.8. Review of Flight Information Publications (FLIP) and Other TERPS Related Material:

2.8.1. **FLIP Products.** FLIP review is an in-depth check of the plan, profile, minima block, radar minimums, and airport sketch ensuring published information mirrors the procedure package. Upon receipt of new products, the initiating TERPS Office will conduct a thorough review (within 5 working days for unit level, 10 for MAJCOM) to check their accuracy because of possible printing errors. Pay special attention to:

2.8.1.1. New Procedures. Compare the new product against the procedure package. The possibility for errors is highest in new procedures.

2.8.1.2. Changes to Existing Procedures. Upon receipt of a new FLIP, check each procedure for printing errors when a new plate is published (Check for a Julian date change to determine plate change).

2.8.2. Errors in Published Procedures. If errors are found which are procedural in nature (see paragraph 2.7.1) consider sending a NOTAM to either stop the use of the procedure or list the corrections.

2.8.3. Review loose-leaf/locally published FLIPs on receipt and during annual review.

2.8.4. Base Civil Engineering Comprehensive Planning Maps or Equivalent. Review revised maps to verify changes/new information.

2.8.5. Obstacle data not considered during development of the instrument procedure (Chart Updating Manual (CHUM), Electronic CHUM {ECHUM}, obstruction evaluations {OE's}, FAA AMIS {Aircraft Management Information System}, obstacle printouts, NIMA Vertical Obstruction File {DVOF} printouts, NOAA Obstacle Charts (OC) and Obstruction Data Sheets {ODS}, etc.). The CHUM lists obstacle changes, additions, and deletions for specific charts/maps and edition number. Cross-check maps/charts used to develop instrument procedures with the CHUM for any possible changes. Document obstacle reviews within the airfield folders.

2.8.6. Planned or completed changes in airfield layout, facilities, lighting, etc. As soon as possible, determine effect of proposed construction/engineering changes on instrument procedures.

2.9. FLIP Maintenance. MAJCOMs will develop a FLIP maintenance system (checklist, operating instructions, etc.) that tracks AIP changes, NOTAMs, CHUM data, and related correspondence, for updating instrument procedures.

2.9.1. **Host Nation Procedures.** Maintain as much source information as possible, following paragraph 2.3.2 as closely as practical.

2.9.1.1. Check the following source documents on a daily basis:

2.9.1.1.1. Host nation AIP. Compare the new procedure against what is published.

2.9.1.1.2. US/host nation NOTAMs.

2.9.1.2. If host nation procedural changes are noted, in advance, and time permits a full review, notify NIMA of changes for inclusion in next FLIP cycle.

2.9.1.3. If time permits a full review and changes will occur before the next FLIP cycle:

2.9.1.3.1. Issue a NOTAM of changes until correct depiction appears in the FLIP.

2.9.1.3.2. NIMA notified of changes.

2.9.1.4. If a full review is not possible, the procedure shall be NOTAMed "NOT AUTHORIZED" until completion of the review.

2.9.1.5. Where possible, establish points of contact (POC) with the host nations to coordinate changes. Exchange agreements are recommended to facilitate crossfeed of information.
2.9.2. **CONUS Procedures.** (Instrument procedures at locations where no unit specialist is available).
2.9.2.1. Maintain the original procedure package as outlined in paragraph 2.3.2, this manual.
2.9.2.2. Upon receipt, conduct a full review of updated CE maps, maps/charts, CHUM supplements to verify if changes have occurred.
2.9.2.3. If changes are proposed, verify the date when the changes take effect. Include the changes in the next FLIP cycle with NOTAM coverage filling time between the actual FLIP publishing date and the effective date of the change.
2.9.2.4. Establish a POC at each location that will provide timely changes to the airfield environment. Establish the POC with the unit(s) requesting the instrument procedures. Thoroughly brief the POC on changes to the airfield environment that affects instrument procedures. Also, establish clear avenue of communications to ensure timely reporting.

2.10. Deleting Instrument Procedures. When a procedure is no longer required:
2.10.1. The requesting unit informs the appropriate TERPS branch to cancel the procedure. (Organizations at any level of command may initiate a deletion.)
2.10.2. The TERPS branch coordinates with other interested agencies (MAJCOM, DoD, FAA, and host nation).
2.10.3. Each reviewing echelon determines whether the deletion will adversely impact any known operations.
2.10.4. If other agencies concur, the MAJCOM TERPS office sends cancellation notice to NIMA through channels shown in figure 2.1 or 2.2. (See paragraph 3.16 for deletion of fix name codes and identifiers.)

Chapter 3

CRITERIA IMPLEMENTATION

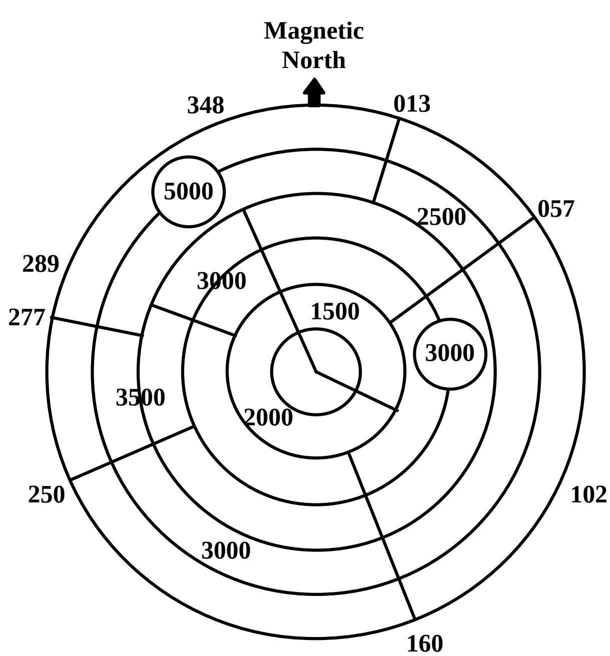
3.1. Category II ILS Operations: All Category II ILS instrument procedures shall contain the caveat: Special Aircrew and Aircraft Certification Required. See Attachment 3, paragraph A3.23 for USAF criteria.
3.1.1. The loss of any of the following components precludes Category II ILS operations and requires issuing a NOTAM by the appropriate facility:
3.1.1.1. Approach lights, runway centerline lights, high intensity runway lights, touchdown zone lights, or all-weather runway markings.
NOTE: Loss of the sequenced flashing lights does not affect CAT II visibility minima.
NOTE: When runway markings are obscured by snow, ice, and/or other weather phenomena, an assessment shall be made by the Senior Operational Commander to determine if CAT II ILS operations may continue. Every effort shall be made to remove the obscuration.
3.1.1.2. Approach end transmissometer.
3.1.1.3. ILS far field monitor.
3.1.2. Loss of the following components will not preclude operations, but, require facility NOTAMs:
3.1.2.1. **Outer Marker.** Provided an authorized substitute fix is available (see AFJMAN 11-226, chapter 9).
3.1.2.2. **Middle Marker.** Provided an authorized substitute fix is available (see AFJMAN 11-226, chapter 9).
3.1.2.3. **Inner Marker.** Failure does not require an increase in landing minima for aircraft equipped with a radar (radio) altimeter.
3.1.2.4. **Rollout End Transmissometer.** Precludes operations below 1600 RVR.
3.1.3. Loss of the following components will not preclude Category II ILS operations and do not require NOTAMs.
3.1.3.1. Backup power for localizer transmitter, GS transmitter, or approach lights.
3.1.3.2. Hold signs.

3.2. Area Navigation (RNAV):
3.2.1. A MAJCOM may approve the use of RNAV systems that meet the accuracy tolerances in FAA Advisory Circular 90-45, *Approval of Area Navigation Systems for Use in the US National Airspace System*. The MAJCOM notifies AFFSA/XOF of the type of aircraft and system approved for RNAV.
3.2.2. The criteria in AFJMAN 11-226, Chapter 15, is the source to develop RNAV procedures.
NOTE: For more information on area navigation, see FAA Handbooks 7110.65 *and 8260.19, Flight Procedures and Airspace.*
3.2.3. To facilitate en route RNAV operations, geographic coordinates are authorized on public use non-RNAV procedures at IAFs and the last fix on departure procedures. Geographic coordinates may be published at any fix on special use procedures. Only procedures developed according to AFJMAN 11-226, chapter 15, will be identified as RNAV procedures.
NOTE: Global Positioning System (GPS) is a form of RNAV, however, separate criteria for GPS has been established in paragraph 3.25.

3.3. Standard Terminal Arrival Route (STAR). Develop STARs only when feeder routes, initial approach segments, or both will not suffice. Use the criteria in AFJMAN 11-226, Chapter 17, and the guidance in FAA Order 7100.9, when developing a STAR. Use FAA Form 7100-4, ***STAR-Standard Terminal Arrival Route***, for processing. *NOTE:* Overseas locations have the option to use the FAA form or AF Form 3637, ***Instrument Approach Procedure***.

3.4. Minimum Vectoring Altitude Chart (MVAC). MVACs shall be approved by MAJCOM TERPS.
3.4.1. The MVAC is designed and centered on the ASR antenna location and may include magnetic bearings, arcs, or point-to-point lines using Lat/Long positions (See figure 3.1). This chart must meet terrain/obstruction clearance first, then operational needs. Areas such as noise abatement, sanctuaries, etc. whose altitudes are actually higher than that of the MVA may be included as part of the MVA or designed separately. Evaluate all obstacles within the maximum range of the primary radar system. If usage of secondary radar is authorized for radar service according to FAAH 7110.65 and AFI 13-203, *Air Traffic Control*, then evaluate obstacles in the designated areas. MVACs do not require flight inspection.
NOTE: Evaluate adjacent Radar facility MVACs for compatibility.
3.4.2. Units with approach control service by FAA shall obtain a current MVAC from the FAA facility for use in developing instrument procedures.
3.4.3. Use AF Form 3632, ***Minimum Vectoring Altitude Chart***, to coordinate and document approval of new/revised MVACs (See paragraph A5.4). Use AF Form 3633, ***Minimum Vectoring Altitude Computations***, to show computations (See paragraph A5.5). AF Form 3632 shall only show data according to AFJMAN 11-226, paragraph 1041a, *Radar Patterns*. Show other segment data on appropriate procedure forms. Update charts as required.
3.4.4. Using a VFR Sectional or equivalent chart that depicts Special Use and Floor of Controlled Airspace, make the center of the MVAC represent the radar antenna site, and divide it into sectors, as required by different obstacle clearance altitudes. The configuration of each section, and the features to be shown, depend on the local terrain and operational considerations. Use the following methods, as applicable.
3.4.4.1. Depict each sector in relation to its magnetic bearing from the antenna site, radials from NAVAIDs, radar display range marks, or controller airspace boundaries. To facilitate a correlation between the chart and radar displays, make the sector boundaries coincide with map overlay or video map data, if possible.
3.4.4.2. Make each sector large enough to permit the vectoring of aircraft within the sector. Establish the boundary of each sector at least 3 miles from obstacle determining the minimum altitude (5 miles, if 40 miles or more from the antenna site). Additionally, evaluate a 3 mile (5 mile if 40 miles or more from the antenna site) buffer around each sector to ensure no obstacle was overlooked in the adjacent sector.
3.4.4.3. If there is a large sector with an excessively high altitude, due to an isolated prominent obstacle, this area must have boundaries which are at least 3 miles from the obstacle (5 miles, if 40 miles or more from the antenna site). In establishing these areas, take care to examine the surrounding contour lines for gradually sloping terrain.

Figure 3.1. Minimum Vectoring Altitude Chart (MVAC) .



3.4.4.4. Determine and depict the minimum altitude in each sector which will provide the required obstacle clearance specified in AFJMAN 11-226, paragraph 1041b(3) except that 2,000 feet of obstacle clearance shall be provided in mountainous areas. Within mountainous areas, obstacle clearance may be reduced to not less than 1,000 feet when necessary to achieve altitude interface with other procedures and when precipitous terrain is not a factor. This minimum altitude must be at least 300 feet above the floor of controlled airspace (Refer to paragraph A5.5 Sections A thru C).

3.5 Minimum Instrument Flight Rules Altitude Chart (MIFRAC). A MIFRAC will be developed only for facilities that control IFR traffic. MIFRACs shall be approved by MAJCOM TERPS.

3.5.1. The MIFRAC is used to assist Air Traffic Controllers determine the lowest useable IFR altitude an aircraft may operate, receive the appropriate NAVAID, and maintain obstruction/terrain clearance. The sectors are determined by radials and arcs and designed to meet operational requirements. Units must coordinate with adjacent ATC facilities to obtain minimum IFR information on navigational aids that fall on or near common airspace boundaries. The design must take into account any NAVAID restrictions published in the IFR Supplement, NAVAID limitations, and a selected sector altitude may not be lower than the MVA for that given area. **CAUTION:** Two or more MVA altitudes may affect a single MIFRAC sector. ***NOTE:*** IFR airways/routes that are approved for use are not affected by the MIFR or MVA altitudes. Evaluate each NAVAID (TACAN, VORTAC, VOR or NDB) within delegated airspace to assist controllers in applying FAR 91 and FAAH 7110.65 for off-route and direct-route operations

3.5.1.1. Depict each sector in relation to radials or distances from NAVAIDs to the boundaries of delegated airspace, however, sectors must not exceed the service volume of the NAVAID. Make sure altitudes established for sectors also provide 1000/2000 feet clearance within 5 NM outside established sectors.

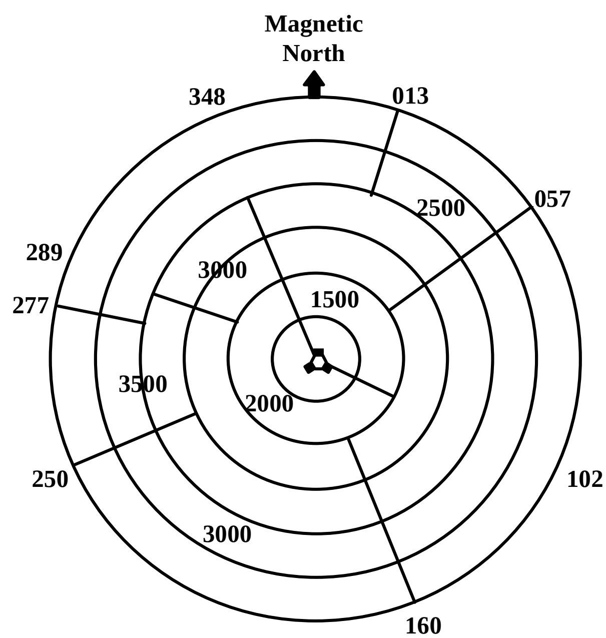
3.5.1.2. Make sure sectors encompass areas where altitude information is not printed on aeronautical charts. Accomplish this by appending the data on the MVAC.

3.5.1.3. Use AF Form 3632, ***Minimum Vectoring Altitude Chart,*** and AF Form 3633, ***Minimum Vectoring Altitude Computations,*** to document the MIFRAC (See paragraphs A5.4 & A5.5). When preparing these forms for the MIFRAC, cross through "VECTORING" in the title and add "IFR."

3.5.2. Prepare a single chart for each selected NAVAID. Using a VFR Sectional or equivalent chart that depicts Special Use and Floor of Controlled Airspace, make the center of the chart represent the center of the NAVAID, and divide the chart into sectors, as required by different obstacle clearance altitudes (See Figure 3.2). The configuration of each section, and the features to be shown, depend on the local terrain and operational considerations. Use the following methods, as applicable.

3.5.2.1. Depict each sector in relation to a radial or magnetic bearing from the NAVAID. To facilitate a correlation between the chart and radar displays, make the sector boundaries coincide with map overlay or video map data, if possible.

Figure 3.2. Minimum Instrument Flight Rules Altitude Chart (MIFRAC) .



3.5.2.2. Make each sector large enough to permit the operation of aircraft within the sector. Establish the boundary of each sector at least 5 miles from obstacle determining the minimum altitude. Additionally, evaluate a 5 mile buffer around each sector to ensure no obstacle was overlooked in the adjacent sector. In establishing these areas, take care to examine the surrounding contour lines for gradually sloping terrain.
3.5.2.3. Determine and depict the minimum altitude in each sector which will provide the required obstacle clearance specified in AFJMAN 11-226, paragraph 1041b(3) except that 2,000 feet of obstacle clearance shall be provided in mountainous areas. Within mountainous areas, obstacle clearance may be reduced to not less than 1,000 feet when necessary to achieve altitude interface with other procedures and when precipitous terrain is not a factor. This minimum altitude must be at least 300 feet above the floor of controlled airspace (Refer to paragraph A5.5 Section A thru C).
3.6. Point in Space Procedure. Establish procedures that do not provide for landing with a minimum descent altitude or decision height (DH) of 500 feet or higher above ground level (AGL). Ceiling and visibility minima may be established. These are special use procedures, annotate per paragraph 1.4.4.

3.7. Publishing ILS Restrictions. Permanent restrictions for ILS facilities, must be published as caution notes: (Example: "Caution: ILS GS unusable below 300 MSL" or "Caution: Autopilot coupled operations NA past DH"). Coordinate with the flight inspector for content of the notes, (see AFJMAN 11-225). Send such restrictions as procedural changes.

3.8. Foreign Procedure Turns:
3.8.1. Chart procedure turns exactly as shown on the foreign procedure, for example, if shown chart an 80/260-degree turn. Include the fix when the turn starts at a fix, rather than at a time or distance determined by the pilot. Determine and publish the outbound and inbound tracks on the 45-degree offset of the 45/180 degree procedure turn when they are not shown on the foreign procedure.
3.8.2. Determine and publish a "Remain within Distance" for the procedure turn that is equal to or less than the distance limitation intended in the foreign procedure. Where the turn starts at a fix, the "Remain within Distance" will be from that fix.
3.8.3. Determine the notes and operational information necessary to convey the intent of the procedure.

3.9. Metric Minima. When developing or reviewing instrument procedures determine the units of measurement (for example, meters, feet, or statute miles [SM]) used in air-to-ground communications for ceiling, RVR, and prevailing visibility (PV) at each airfield. Make minima computations as outlined in AFJMAN 11-226 to the point that publishable minima are defined in feet for ceiling and RVR, and SM for PV. When meters are used, convert feet or SM to meters using the equivalent values in attachment 2.

3.10. Applying APATC-1. Apply APATC-1 when developing or revising US Air Force procedures, adopting foreign military procedures of NATO subscribing nations, and where operations can be improved in the area covered by the Europe, North Africa, and Middle East DoD FLIP Terminal. Exceptions to APATC-1 are:

APATC-1	**APPLY**
Chapter 2, Section V	AFJMAN 11-226, Chapter 2, Section 5 and AFMAN 11-230, Attachment 3
Chapter 3	AFJMAN 11-226, Chapter 3 and AFMAN 11-230, Attachment 2 & 3

3.11. Separating Instrument Procedures From Special Use Airspace. Due to the many variables of special use airspace, specific criteria that would apply to all cases are not feasible; therefore, a case-by-case approach is essential. Separate primary obstacle clearance areas from special use airspace, where possible, without sacrificing flyability. When this is not possible, evaluate all factors and send as a nonstandard procedure (figure 2.2).

3.12. Obstacles of Variable Height or Location. An obstacle may be ignored when means are established to control its height, location, or both. A construction crane or traffic on a perimeter road are good examples. Corrective procedures must be defined in an LOP.

3.13. Flyability Check and Flight Inspection of Instrument Procedures:
3.13.1. Perform the flyability check using AF FORM 3992, ***Instrument Procedure Flyability Check, Instrument Approach Procedure (IAP)***, and AF Form 3993, ***Instrument Procedure Flyability Check, Standard Instrument Departure (SID),*** by simulating the most restrictive aircraft category. The entire procedure must be evaluated. ***NOTE:*** When conducting flyability checks at Host Nation airfields, it may be difficult to evaluate the entire procedure. For portions of the IAP that cannot be flown, pilots will visually evaluate the probability of satisfactory NAVAID/Radio reception, obstacle and terrain clearance, e.g., If the missed approach segment cannot be flown on arrival, an assessment can be made when departing, if practical. The procedure is acceptable if the pilot conducting this check determines that:

3.13.1.1. The procedure is operationally sound; that is, required aircraft maneuvering is consistent with good operating practices.
3.13.1.2. Cockpit workload is acceptable.
3.13.1.3. Charts can be easily interpreted and contain proper information.
3.13.1.4. The procedure ensures safety of flight using the guidance in AFMAN 11-217, *Instrument Flight Procedures*, or as explained in the procedure.

NOTE 1: See attachment 9 for instructions on the use of AF FORM 3992, ***Instrument Procedure Flyability Check, Instrument Approach Procedure (IAP)***, and AF Form 3993, ***Instrument Procedure Flyability Check, Standard Instrument Departure (SID)***.
NOTE 2: The MAJCOM Director of Operations may waive the requirement for a "live" flyability check at host nation airfields in one or both of the following situations:

- The airfield is located in a country identified with an asterisk (*) on the HQ AFFSA Host Nation Acceptance List.
- The airfield is routinely served by a U.S. FAR Part 121 air carrier (Every effort should be made to contact the appropriate U.S. Operator to determine if special restrictions have been established for operating at this airport. If restrictions have been established by the air carrier, the MAJCOM will evaluate whether these restrictions should be applied).

NOTE 3: If the "live" flyability check is waived by the MAJCOM Director of Operations or a portion of the procedure could not be flown, a flight simulator or "table top" review shall be accomplished and documented on AF Form 3992, ***Instrument Procedure Flyability Check, Instrument Approach Procedure (IAP)*** or AF Form 3993, ***Instrument Procedure Flyability Check, Standard Instrument Departure (SID),*** which ever is appropriate. These forms shall be maintained with the TERPS procedure package.
3.13.2. Validate U.S. Air Force procedures that require the use of Instrument Flight Rules according to AFJMAN 11-225, Section 214 except when it is a special use procedure and:
3.13.2.1. Uses NAVAIDs that have been flight inspected according to AFJMAN 11-225.
3.13.2.2. Is within the service volume and usable coverage of the NAVAIDs used.
3.13.2.3. Has received a flyability check and the controlling obstacle in each segment of the procedure verified by the using (requesting) agency.
3.13.2.4. Aircraft using the procedure are monitored by ATC radar throughout the procedure and the procedure noted "RADAR REQUIRED."
3.13.3. If all the requirements of paragraph 3.13.2 cannot be fulfilled, the procedure requires flight inspection.
3.13.4. Flight inspection of host nation instrument procedures conducted by the host country (not conducted by the FAA International Flight Inspection Office {IFIO}), are acceptable as long as the flight inspection authority adheres to either FAAO 8200.1 or ICAO Annex 10 criteria.

3.14. VMC Procedures. When a procedure is limited to use in VMC conditions, publish a note: FOR VMC USE ONLY. These procedures do not require formal review and processing, flight inspection, or waiver action for deviations.

3.15. Combining Procedures. The primary reason for combining instrument approach procedures is to facilitate pilot actions when flying multi-receiver aircraft. Procedures must first be developed as stand-alone procedures and may be combined on a single chart provided:
3.15.1. Aircrew confusion or chart clutter does not result.
3.15.2. The final approach courses are within 4 degrees and only one track is depicted. Show no more than two final approach courses. Example: ILS 150°/TAC 154°.
3.15.3. Only one non-precision FAF and altitude, step-down fix (most restrictive) and altitude, VDP, and non-precision missed approach point (MAP) is established.
3.15.4. Circling minima are common.
3.15.5. Missed approach procedures are common, except that precision and non-precision MAPs may differ.

3.16. Fix Name Codes and Identifiers. The Unit TERPS office shall submit a request for Fix Name Codes and Identifiers through their MAJCOM. The MAJCOM shall obtain name codes from the FAA National Flight Data Center (NFDC) Airspace Section for ATC coordination fixes, IAFs overhead facilities with two-letter identifiers, and fixes on U.S. Air Force instrument approaches in airspace under U.S. jurisdiction according to FAA Order 7350.6, *Location Identifiers*. This request can be made by telephone. The unit will complete the FAA Form 8260-2 and forward the request through their MAJCOM for processing IAW FAAO 8260.19. Fix names no longer required will be returned to the NFDC for re-distribution. ***NOTE:*** Obtain name codes or identifiers for such fixes elsewhere from the country with jurisdiction over the airspace where the fix is located.

3.17. Civil Approach Charts for USAF Approach Control Facilities.
3.17.1 Obtain National Ocean Service (NOS) approach charts from NIMA. These charts are purchased on an independent basis. Submit requirements per NIMA Catalog. Submit required information in NIMA Catalog to AFFSA/XOIP, and include:
3.17.1.1. Airport name and location.
3.17.1.2. Procedure designation book identification.
3.17.1.3. Number of copies needed.
3.17.1.4. Base NIMA account number.
3.17.2. Route unit requests, through Airfield Operations (FLIP Distribution Manager), to AFFSA/XOIP. Request should indicate that the charts be mailed to the host base operations for distribution to the requesting unit. If the procedure is published in DoD FLIP, the unit will cancel the distribution.

3.18. Air Space Requirements. When procedures require establishing or changing airspace, process the airspace requirements according to AFI 13-201, *US Air Force Airspace Management,* FAAH 7400.2, *Procedures for Handling Airspace Matters*, and FAAO 7610.4H, *Special Military Operations.* Coordinate with local military airspace manager for matters concerning Special Use Airspace (SUA). Coordinate with MAJCOM and FAA AFREP for all other airspace matters.

3.19. Displaced Threshold Procedures. Displacing, relocating, or moving the threshold may have an adverse effect on instrument approach/departure procedures. TERPS personnel shall revise instrument procedures as necessary to ensure flight safety. Only those procedures considered mission essential will be adjusted based on the following guidance:
3.19.1. A new threshold/departure end must be established. Obstacles that lie within the displaced area, machinery/vehicles, must be evaluated to ensure the procedure continues to meet TERPS criteria. If used at night or in IMC, runway lighting must include threshold lighting for the displaced threshold (See AFI 32-1044, ***Visual Air Navigation Systems***).
3.19.2. Approach lights will not be usable for taking a reduction in visibility minimums. Re-compute no-light minima by adding the amount of displacement to the "MAP-to-Threshold" distance.
3.19.3. Suspend ILS operations, except localizer only. Turn off the glideslope until the normal runway configuration is restored. NOTE: There may be situations where the threshold is displaced a short distance without affecting precision capability. To determine if precision capability can remain, the relocated Threshold Crossing Height must be computed and be in compliance with AFJMAN 11-226, paragraph 934b (Paragraph 1026b for PAR). Consideration must also be given to what will be located in the closed portion of the runway. For example, if men and equipment will be located in the closed portion, the OIS must be evaluated to ensure proper obstacle clearance.
3.19.4. Visual glideslope indicator systems (VASI/PAPI/PLASI) may be unavailable for the same reason as the ILS.
3.19.5. PAR approaches may be unusable for the same reason as for ILS.
3.19.6. The elevation of the new threshold and touchdown zone will more than likely change. In this case, revise the height above touchdown portion of the approach minima.
3.19.7. The airport elevation might also change. This requires a revision to the height above airport elevation on circling procedures.
3.19.8. Evaluate climb gradients on required departure procedures during threshold displacement. Compute new climb gradients based upon redesign of the departure trapezoid.
NOTE: The intent of this paragraph is for those situations when the threshold will be temporarily displaced. You are not required to completely redesign each procedure to the displaced threshold.

3.20 NAVAID Service Volume. All procedures will be reviewed to ensure that all NAVAIDs being used fall within the Service Volume(s) established in FAAO 8260.19, Chapter 2. If an Expanded Service Volume (ESV) evaluation is required, refer to Attachment 5, paragraph A5.20, for instructions on completing FAA Form 6050-4, ***Expanded Service Volume Request.***

3.21. Aircraft Surge Launch and Recovery (ASLAR). Develop ASLAR procedures using AFMAN 13-214, *Aircraft Surge Launch and Recovery Operations,* chapter 6, AFJMAN 11-226, or APATC-1, and this attachment for the particular type of procedure desired. The following information applies:
3.21.1. **ASLAR Terms:**
3.21.1.1. *DRAG Point.* The location on a procedure where the aircraft landing second in a formation decelerates from the established speed of the formation to a standard airspeed which will provide for required flight separation before landing. (Example: Fighter aircraft fly 300 Knots Indicated Airspeed (KIAS) until DRAG, where the aircraft landing second slows to 180 KIAS.)
3.21.1.2. *DECEL Point*. The published location (normally 11-14 NM from the runway) on an approach procedure where single ship, formation wing landings, and the aircraft landing first in a two-ship formation decelerate from 300 KIAS to a standard airspeed. (Example: Fighter aircraft will slow to 180 KIAS.)

3.21.1.3. *Final Approach Speed (FAS) Point.* The location on a procedure where all aircraft will decelerate to their final approach speed. (Example: Fighter aircraft will slow from 180 KIAS to their computed final airspeed.)
3.21.2. **Published Information.** The following information will be published:
3.21.2.1. Identification of ASLAR procedures. AFJMAN 11-226, chapter 1, Section 6, applies, except the word ASLAR will be included at the beginning of the procedure title, e.g., (ASLAR) HI-TACAN Rwy 17.
3.21.2.2. Geographic coordinates for the IAF, intermediate fix, NAVAID, and approach end of the runway. Each set of coordinates will be determined for degrees, minutes, and hundredths of a minute and the datum used will be identified.
3.21.2.3. The DRAG, DECEL, and FAS points.
3.21.2.4. Update fixes (radial and DME) when required by A3.21.3.2.
3.21.3. **Initial Approach Segment Based on Fix-to-Fix (FTF) Navigation:**
3.21.3.l. *Alignment.* When the FTF track intercepts the intermediate course, the point of intercept will be a minimum distance of 1 mile before the Intermediate Fix (IF) for every 3 miles flown on the FTF track. The point of intercept will be a maximum distance of 4 miles from the IF. Ninety degrees is the maximum intercept angle.
3.21.3.2. *Area.* The length of the initial approach segment, using FTF will be as required by operational considerations. If this segment is longer than 10 miles, update fixes will be provided at regular intervals not to exceed 10 miles. (Examples: For a 15 mile FTF segment, one update fix is required at approximately 7 to 8 miles; for a 25 mile FTF segment, two update fixes are required at approximately 8 and 16 miles.) The primary obstacle clearance area commences at the IAF and extends 6 miles on each side and parallel to the FTF track. Secondary areas are not used.
3.21.4. Circling maneuver not authorized per AFMAN 13-214, chapter 6.

3.22. Side-Step Maneuver (SSM) Procedures. A SSM is a procedure where the final approach is aligned to one runway, and a visual maneuver is made to land on a parallel runway. A SSM to a parallel runway is authorized under the following conditions:
3.22.1. Runway centerlines are separated by 1200 feet or less.
3.22.2. Only one final approach course is published.
3.22.3. Course guidance is provided within 3 degrees of the runway centerline of the primary runway.
3.22.4. The procedure is identified according to AFJMAN 11-226, paragraph 161.
3.22.5. Final approach areas must be established for both runways and determined by the approach guidance provided. Both final approach areas must be used to determine the MDA to the sidestep runway. The final approach area of the sidestep runway must extend from a point abeam the FAF to the side-step runway threshold.
3.22.6. The same non-precision obstacle clearance used for the primary runway is used to determine the published MDA for the side-step maneuver.
3.22.7. Visibility Minima:
3.22.7.1. Published visibility's are according to AFJMAN 11-226, table 6, using the side-step HAT (SSM MDA-SSM Runway Touchdown Zone (TDZ) Elevation = SSM HAT) or table 11, whichever is greater.
3.22.7.2. If the distance between the FAF and side-step runway threshold is less than the minimum no-lights visibility, a SSM for that approach category is not authorized.
3.22.7.3. Published visibility's must not be less than the distance between the MAP and the side-step runway threshold.
3.22.7.4. Credit for lights installed to the sidestep runway may be applied according to chapter 3, except read references to straight-in as side-step. The minimum visibility after applying credit for lights must be no less that 1 mile.
3.22.8. The criteria for descent gradients are in AFJMAN 11-226, paragraph 513d(1), except the gradient is based on:
3.22.8.1. The distance from the FAF or step-down fix to the side-step runway threshold.
3.22.8.2. The height difference between the minimum altitude at the FAF or step-down fix and the TDZ elevation of the side-step runway.
3.22.9. Minima are published as shown below, assuming the following conditions: Runways 27L and 27R with 1200 feet separation and the ILS installed on Runway 27L, the procedure would be identified as ILS Runway 27L, and minima printed as such:

S-ILS 27L
S-LOC 27L
Side-Step- 27R
Circling

3.23. ASR Recommended Altitudes:
3.23.1. Determine recommended altitudes by multiplying the descent gradient by the number of miles, then add the appropriate elevation.
3.23.1.1. For approaches with published straight-in minima, use touchdown zone (TDZ) elevation.
3.23.1.2. For circling approaches (having only one circling minima) use airport elevation.
3.23.1.3. For point in space approaches, use the missed approach point elevation.

Table 3.1. Sample Recommended Altitudes.

6 mile - TDZ/Airport/Heliport/MAP + 1800 feet
475 + 1800 = (2275) 2260
5 mile - TDZ/Airport/Heliport/MAP + 1500 feet
475 + 1500 = (1975) 1960
4 mile - TDZ/Airport/Heliport/MAP + 1200 feet
475 + 1200 = (1675) 1660
3 mile - TDZ/Airport/Heliport/MAP + 900 feet
475 + 900 = (1375) 1360
2 mile - TDZ/Airport/Heliport/MAP + 600 feet
475 + 600 = (1075) 1060
1 mile - TDZ/Airport/Heliport/MAP + 300 feet
475 + 300 = (775) 760

3.23.2. The example in table 3.1 uses a gradient of 300 feet per mile and a TDZ elevation of 475 feet. The sum is rounded to the next lower 20 foot increment. The rounded values are recommended altitudes for the corresponding mile from the runway.

3.24. FAA Forms and Publications.

3.24.1. FAA forms referenced throughout this manual can be obtained from the MAJCOM TERPS office. MAJCOMs can obtain FAA forms from HQ AFFSA via the File Transfer Protocol (FTP) access FORMS directory.

3.24.2. FAA publications referenced in AFJMAN 11-226 and this manual are approved for USAF use as stated. Example, AFJMAN 11-226, Chapter 2, Section 9, refers you to FAAH 7130.3 for Holding criteria. This manual (AFMAN 11-230) makes reference to FAAO 8260.19 for instructions on filling out FAA Form 8260-2, ***Radio Fix and Holding Data***. The first example allows you to apply all applicable criteria within the publication as stated, where the second example allows you to apply only a portion of the FAA publication. Attachment 1, *Glossary of References, Abbreviations, Acronyms, and Terms,* is provided for the TERPS Specialist for two purposes. The first is to establish a requirement for the TERPS Specialist to maintain certain publications necessary in the performance of his/her duties. The second purpose is to provide a list of reference publications that could assist the TERPS Specialist in the performance of their duties.

NOTE: Attachment 1 is **not** to be considered a list of approved FAA publications. Certain portions of these publications may be approved for USAF use and will be identified in a USAF publication.

3.25. Non-Precision Global Positioning System (GPS) Instrument Approach Procedures (IAPs). Develop non-precision GPS IAPs using criteria in FAAO 8260.38, *Civil Utilization of Global Positioning System (GPS).*

3.25.1 The USAF takes exception to criteria in paragraph 11a as follows:

3.25.1.1. Course changes at the Intermediate Waypoint shall not exceed 90 degrees.

3.25.2. The USAF will not develop “Overlay” GPS IAPs. NOTE: USAF aircraft are not permitted to fly overlay GPS IAP’s (See AFI 11-206, *General Flight Rules).*

3.25.3. GPS procedures will be processed IAW AFMAN 11-230, Chapter 2. Procedure package will also include AF Form 3981, ***GPS/RNAV Descent Angle and Surface Evaluation***, and AF Form 3982***, GPS/RNAV Combination Straight and Turning Missed Approach Length of Section 1***, if applicable.

3.25.4. Descent angles will be published in the profile view of the procedure IAW AFJMAN 11-226, paragraph 1523f.

3.25.4.1 A descent angle will not be published if the Missed Approach Waypoint (MAWP) is not over the threshold.

3.25.5. When developing High altitude GPS procedures, use the same (low altitude) criteria and AFJMAN 11-226, paragraph 232d, *Descent Gradient,* criteria.

3.25.6. When the basic “T” design method is used, the IAF’s at the outer edges of the top of the “T” shall not be less than 5 NM from the center IAF/IF.

3.26. Category I Microwave Landing System (MLS). Develop MLS procedures using the criteria in FAA Order 8260.36, *Civil Utilization of Microwave Landing System (MLS).*

3.27. Mobile Microwave Landing System (MMLS).

This criteria requires application of the Runway Imaginary Surfaces criteria outlined in AFJPAM 32-8013 Volume 2, *Planning and Design of Roads, Airfields and Heliports in the Theater of Operations - Airfield and Heliport Design,* and AFMAN 32-1013, *Airfield and Heliport Planning and Design*. The appropriate civil engineering organization shall determine that the Runway Imaginary Surfaces criteria are met. Design criteria specified in this document applies to Short Fields, Fixed-Wing Landing Zones, and Class "B" runways for training purposes only. Class "B" runways, do not install the MMLS in the collocated configuration for more than 30 days. Design approaches for the highest approach speed category expected to use the approach. The minimum glideslope angle is

2.5°. The maximum glideslope angle is 6.40°. Angles above 3.60° shall not be established without Headquarters Air Force Flight Standards Agency Instrument Procedures Branch (HQ AFFSA/ XOIP) approval.

3.27.1 **Definitions.** The following definitions apply:

3.27.1.1. Along Track Distance (ATD). Distance measured along a flight course, measured in nautical miles.

3.27.1.2. Collocated Azimuth and Elevation Antennas. Azimuth antenna installed within 6 feet of the elevation antenna.

3.27.1.3. Final Centerline Segment (FCLS). That portion of the approach (last roll out point prior to DH) where no further course changes shall be required.

3.27.1.4. Glidepath angle. The angular displacement, expressed in tenths of a degree, of the vertical guidance path with a horizontal plane passing through the antenna phase center. This angle is published on the approach chart (e.g., 3.00º, 3.10º, etc.).

3.27.1.5. Glidepath Intercept Point (GIP). This point is the beginning of the precision final approach segment and coincides with the intersection of the glideslope and the intermediate segment altitude. At this point descent is authorized to the decision height. This point must be at or prior to the non-precision final approach fix (FAF).

3.27.1.6. Mobile MLS (MMLS). A mobile MLS which consists of azimuth, elevation and Distance Measuring Equipment (DME) components.

3.27.1.7. Required Obstacle Clearance (ROC). The minimum vertical separation between the glidepath or authorized flight altitude and an obstacle.

3.27.1.8. Service Limitation. The azimuth service limitation is 15 miles from the facility, within ± 40º of the center course. The elevation service limitation is 15 miles from the facility and from 2.5° to 15° (see Figure 3.3).

3.27.2. **MMLS Approach Types:**

3.27.2.1. **MMLS Category I.** A precision approach procedure with a decision height (DH) of not less than 200 feet Height Above Touchdown zone (HAT) elevation.

3.27.2.2 **MMLS Category II.** Criteria not approved.

3.27.2.3. **MMLS Category III.** Criteria not approved.

3.27.2.4. **Azimuth (AZ) Only.** Approach procedures which do not use the elevation components of the MMLS.

3.27.2.5. **Computed MMLS.** A collocated azimuth and elevation antenna site as specified in paragraph 1.2.2. Provide guidance along the extended runway centerline to account for offset installation of the azimuth antenna. MMLS DME information is derived from an antenna located on top of the azimuth antenna. Use of external DME source (TACAN or VOR/DME) is not authorized. Computed MMLS requires special aircraft avionics and may not support normal civil operations.

3.27.3. **System Components:**

3.27.3.1. **Azimuth (AZ) (Course Guidance).** Final centerline segment (FCLS) lateral guidance is normally provided along the 0° reference azimuth signal emanating from the azimuth antenna usually aligned along the runway centerline (see Figure 3.3).

3.27.3.2. **Elevation (EL) (Vertical Guidance).** Vertical guidance is provided by a signal emanating from the elevation antenna phase center. The glidepath for a procedure will be the lowest glidepath permitted by obstacles or signal quality. The glideslope will be no lower than 2.5°. The MMLS receiver allows the pilot to select glidepaths above the minimum established glidepath..

3.27.3.3. **MMLS Distance Measuring Equipment (MMLS DME).** The azimuth antenna is equipped with DME. The accuracy of the MMLS DME can support computed approaches with an azimuth antenna offset of up to 450 feet from centerline. When used as a ranging source for determining the final approach fix the accuracy is ±0.2 NM or ±1216 feet and is referenced to the azimuth antenna site..

3.27.3.4. **Conventional Distance Measuring Equipment.** An external DME system not normally installed in conjunction with the MMLS system. These systems are associated with distance information derived from a TACAN or the DME portion of a VOR/DME. The aircraft must be able to simultaneously interrogate both DME and MLS signals. DME from an external source will not support a computed MMLS approach..

3.27.4. **FIXES:** Within the MMLS coverage area, the following applies:

3.27.4.1. MMLS DME fix error is ± 0.2 miles.

3.27.4.2. Publish all DME distances to the nearest tenth of a mile.

3.27.4.3. MMLS fixes, including the Missed Approach Point (MAP), shall be formed by DME. For precision finals, the MAP is a point on the final approach course where the height of the glideslope equals the authorized decision height.

3.27.4.4. Establish the MAP at the DH location. Publish the distance from the DME antenna to the DH location.

3.27.4.5. Establish the FAF by DME and publish the distance from the DME antenna. Establish the FAF at or inside the glideslope intercept point. When the DME signal is from a source other than the MMLS DME antenna, the aircraft must be able to simultaneously interrogate both DME and MLS signals. This does not apply for computed approaches.

3.27.5. **Inoperative System Components.**

3.27.5.1. **Azimuth Failure.** When the azimuth transmitter is inoperative, no approach is authorized.

3.27.5.2. **Elevation Failure.** When the elevation transmitter is inoperative, the MMLS straight final approach procedure may revert to a non-precision procedure. The obstacle clearance area in para 3.27.12.1.2 applies. The ROC in the final segment is 250 feet.

3.27.5.3. **DME Failure.** For split-site locations, when the MMLS DME transmitter is inoperative, some other means should be employed to determine position along the approach course; such as DME from a TACAN or VOR/DME. If this is not possible, a precision approach may be flown provided there is another means of identifying the FAF such as RADAR. When DME and elevation are not available, a non-precision approach is not authorized. For collocated facilities when the MMLS DME transmitter is inoperative computed approaches are not permitted.

3.27.6. **Ground Point Intercept (GPI) and Threshold Crossing Height (TCH).** The optimum threshold crossing height is 50 feet. The maximum TCH can be found on Table 3.2 for the appropriate glideslope. The minimum TCH is 32 feet. For threshold crossing heights greater than 60 feet, ensure consideration is given to effective placement of approach light systems. The GPI and TCH are computed relative to the final approach course which may not be along the runway centerline (see Figure 3.3). An example of computations to determine GPI and TCH using 3° as the glidepath (GP) angle, is shown as follows:

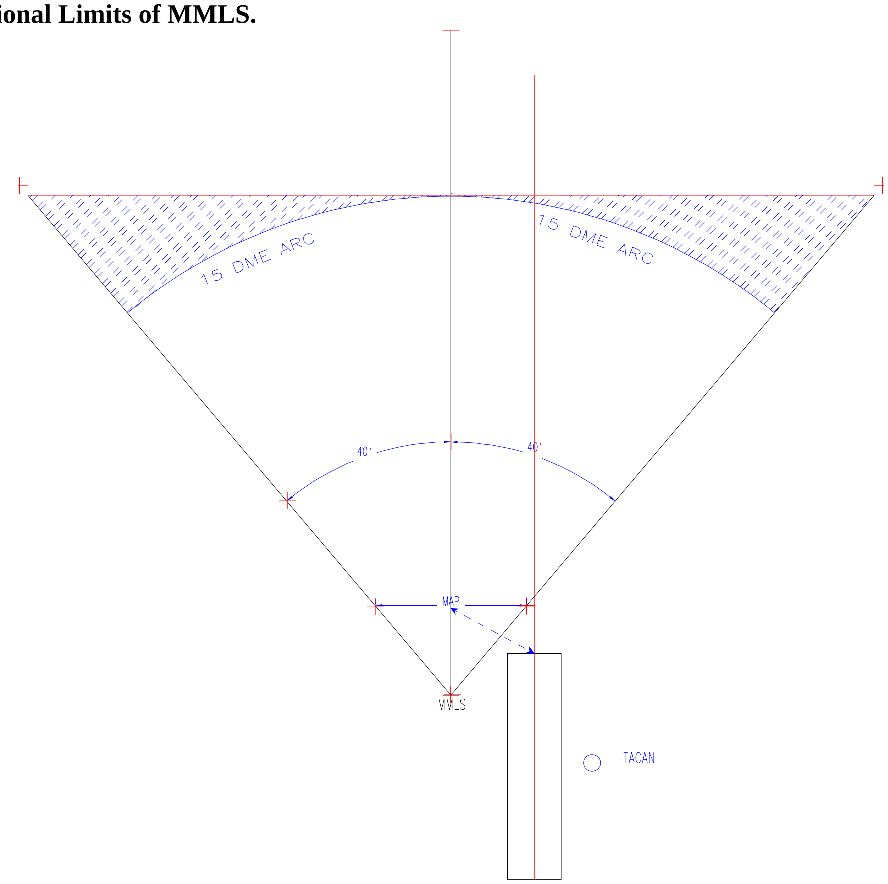
From antenna siting we know:
*Phase Center of Elevation Antenna = 1802.62' MSL
Threshold Elevation = 1795.81' MSL
Antenna to Threshold Distance = 840.00 ft
Glideslope = 3.0°

Phase center of Elevation Antenna		802.62 ft
Threshold Elevation		- 1795.81 ft
Altitude Difference		= 6.81 ft
	$6.81 \div \tan 3^\circ$	= 129.94 ft
Elevation antenna to threshold distance		840.00 ft
GPI to threshold distance		969.94 ft

$$TCH = 969.94 \times \tan 3^\circ = 50.83 \text{ ft}$$

* NOTE: MMLS elevation antenna phase center is nominally five feet above ground level.

Figure 3.3. Operational Limits of MMLS.



3.27.7. **Elevation Antenna Planning.** Computations of GPI and TCH, AF Form 3979, ***MMLS TERPS Computations***, should be conducted prior to elevation antenna installation. Responsible agencies must make a coordinated effort to attain an installation which will support the best instrument approach procedures that criteria will allow. The upper limits of the TCH is closely associated with the glideslope angle (see Table 3.2). The following items are suggested as a basic checklist:

- Consider category aircraft for the runway.
- Select desired TCH.
- Select desired glidepath angle (initially 3.0°).
- Compute GPI.

3.27.7.1. Perform Obstruction Evaluation and Airport/ Airspace Analysis and TERPS feasibility study including necessary actions such as:

- Removing obstructions.
- Displacing threshold.
- Adjusting DH, and/or
- Increasing glidepath angle.

3.27.7.2 Formulas.

- Check TCH limits (see Table 3.2).
- GPI adjustments.
- Repeat MMLS criteria alterations as necessary.

3.27.7.3. Select elevation antenna installation site based on the finalized TCH, glidepath, and GPI configuration procedures.

3.27.8. Procedure Design Limitations.

Development of MMLS procedures shall be independent of existing procedures. Only straight-in procedures are authorized. Curved, angled, or side-step procedures are not permitted.

3.27.9. **Altitude Selection.** Altitudes for the final approach fix, turn point fix (when used), intermediate fix, and initial approach fix shall be determined by applying the appropriate ROC to the controlling obstacle in the preceding segment and round to the next higher 100 foot increment.

3.27.10. Circling Approach.

Circling procedures will not be authorized with this procedure.

3.27.11. **Identification.** Procedures for MMLS shall be identified to be meaningful to the pilot and to permit ready identification in air traffic control phraseology. For collocated MMLS antennas, the procedure will be shown as COMP MMLS and runway number, e.g., **COMP MMLS RWY 23**. For split-site antennas, the procedure will be shown as MMLS and runway number, e.g., **MMLS RWY 6**.

3.27.12. **Procedure development**. Each procedure designed for MMLS, as with any other procedure, will develop the final segment first. A cautionary note must be placed on each procedure “FOR USAF AIRCRAFT ONLY.” Procedures developed for collocated facilities will also include a note stating “FOR USE BY AIRCRAFT CAPABLE OF COMPUTING OFFSET RUNWAY CENTERLINE ONLY.”

3.27.12.1 Final Approach Segment**:** Except as noted below, use criteria in AFJMAN 11-226, Section 3, to develop the MMLS final segment.

3.27.12.1.1**.. Alignment.**

- For split-site facility, see AFJMAN 11-226, Chapter 9, paragraph 930a, for alignment criteria.
- For a collocated facility, align the final approach course with the extended runway centerline. The aircraft equipment will displace the final approach course of the Navigational Aid (NAVAID) to the centerline of the runway. Publish the distance of offset from the runway centerline to the center of the MMLS azimuth to the nearest tenth of a foot. (See Figure 3.3)

3.27.12.1.2. **Length.** For split-site and collocated facilities, see AFJMAN 11-226, Chapter 9, Paragraph 930b(1)(a). Except that the area will continue to the FAF, plus fix error associated with the NAVAID which will provide the DME for determining the FAF. The minimum length of the final segment will be no less than 3 miles from DH. The optimum length of the final segment is 5 miles. The maximum length of the final segment is 10 miles.

3.27.12.1.3. **Width.** See AFJMAN 11-226, Chapter 9, paragraph 930b(1)(b).

3.27.12.1.4. **Final Approach Obstacle Clearance Surface.** Establish the surface as directed in AFJMAN 11-226, Chapter 9, paragraph 931, except the surface will continue beyond the FAF until fix error is included or the glidepath intercept point. Use Table 3.4 for slope of inner and outer sections.

3.27.12.1.5. **Descent Gradient (DG).** The descent gradient will be published with each glideslope. See Table 3.3 to determine the appropriate DG.

3.27.12.2. **Intermediate Segment**. Use criteria in AFJMAN 11-226, Chapter 9, Section 2, except the intermediate segment begins at the Intermediate Fix (IF) and terminate at the FAF.

3.27.12.3.. **Initial Segment**. Use criteria in AFJMAN 11-226, Chapter 9, Section 2, except the initial segment begins at the Initial Approach Fix (IAF) and ends at the Intermediate Fix (IF).

Table 3.2. TCH Upper Limits.

TCH UPPER LIMITS								
HAT	GLIDE SLOPE°	TCH UPPER LIMIT feet	HAT	GLIDE SLOPE°	TCH UPPER LIMIT feet	HAT	GLIDE SLOPE°	TCH UPPER LIMIT feet
200	2.50 - 3.20	75	**250**	2.50 - 4.10	75	**270**	2.50 - 4.40	75
	3.21 - 3.30	70		4.11 - 4.20	71		4.41 - 4.50	73
	3.31 - 3.40	66		4.21 - 4.30	67		4.51 - 4.60	68
	3.41 - 3.50	63		4.31 - 4.40	62		4.61 - 4.70	64
	3.51 - 3.60	59		4.41 - 4.50	58		4.71 - 4.80	59
	3.61 - 3.70	55		4.51 - 4.60	54		4.81 - 4.90	55
	3.71 - 3.80	50		4.61 - 4.70	50		4.91 - 5.00	51
	3.81 - 3.90	47		4.71 - 4.80	45		5.01 - 5.10	46
	3.91 - 4.00	43		4.81 - 4.90	41		5.11 - 5.20	42
	4.01 - 4.10	39		4.91 - 5.00	37		5.21 - 5.30	37
	4.11 - 4.20	35					5.31 - 5.40	35
300	2.50 - 4.90	75	**350**	2.50 - 5.60	75			
	4.91 - 5.00	71		5.61 - 5.70	70			
	5.01 - 5.10	66		5.71 - 5.80	65			
	5.11 - 5.20	61		5.81 - 5.90	60			
	5.21 - 5.30	56		5.91 - 6.00	55			
	5.31 - 5.40	52		6.01 - 6.10	50			
	5.41 - 5.50	48		6.11 - 6.20	45			
	5.51 - 5.60	43		6.21 - 6.30	40			
	5.61 - 5.70	39		6.31 - 6.40	35			

Table 3.3. Glideslope Angles and Associated Descent Gradients.

GLIDESLOPE ANGLE	DESCENT GRADIENT (FT per NM)
2 degrees	212.18
3 degrees	318.43
4 degrees	424.88
5 degrees	531.59
6 degrees	638.62
7 degrees	746.05

3.27.13. **Takeoff and Landing Minimums.** Takeoff and landing minimums shall be established for MMLS procedures in accordance with AFJMAN 11-226, Chapter 3, except as noted in this pamphlet. See Table 3.4 for precision minimums.

3.27.13.1. Portable approach lighting systems may be used for this operation provided they are equivalent to those listed for lighting credit in AFJMAN 11-226.

3.27.13.2. Runway markings for precision approaches, AFJMAN 11-226, paragraph 342. Senior operational commanders may waiver these requirements at assault strips and forward operating locations for contingency operations only. In this situation, no-light minimums will be used.

3.27.13.3. When RVR equipment is not available, the visibility will be expressed as Prevailing Visibility.

3.27.14. **Missed Approach.** The mobile microwave landing system does not provide back course azimuth. Course guidance used beyond MAP shall be based on another source. NOTE: MMLS DME can be used in the missed approach segment. Apply Instrument Landing System (ILS) missed approach criteria as found in AFJMAN 11-226, Chapter 9, Section 4. If no other ground-based NAVAID is available, use the criteria published in AFJMAN 11-226, Chapter 10, Section 3. When radar is used for the missed approach, publish a note stating “RADAR REQUIRED.”

Table 3.4. Glideslope Angles Vs Slopes of Surfaces.

MMLS GS Angle Vs Slopes of Surfaces					
GS Angle (Degrees)	**Slope of Inner Section**	**Slope of Outer Section**	**GS Angle (Degrees)**	**Slope of Inner Section**	**Slope of Outer Section**
2.0º	96.6 : 1	61.5 : 1	4.2°	19.0 : 1	18.2 : 1
2.1º	81.5 : 1	55.5 : 1	4.3°	18.3 : 1	17.7 : 1
2.2º	70.5 : 1	50.6 : 1	4.4°	17.7 : 1	17.2 : 1
2.3º	62.1 : 1	46.5 : 1	4.5°	17.1 : 1	16.6 : 1
2.4º	55.5 : 1	43.0 : 1	4.6°	16.6 : 1	16.2 : 1
2.5º	50.1 : 1	40.0 : 1	4.7°	16.1 : 1	15.7 : 1
2.6º	45.7 : 1	37.4 : 1	4.8°	15.6 : 1	15.3 : 1
2.7º	42.0 : 1	35.1 : 1	4.9°	15.2 : 1	14.9 : 1
2.8º	38.9 : 1	33.1 : 1	5.0°	14.7 : 1	14.5 : 1
2.9º	36.2 : 1	31.3 : 1	5.1°	14.3 : 1	14.2 : 1
3.0º	33.8 : 1	29.6 : 1	5.2°	13.9 : 1	13.8 : 1
3.0º	33.8 : 1	29.6 : 1	5.3°	13.5 : 1	13.5 : 1
3.1º	31.8 : 1	28.2 : 1	5.4°	13.2 : 1	13.2 : 1
3.2º	29.9 : 1	26.8 : 1	5.5°	12.9 : 1	12.9 : 1
3.3º	28.3 : 1	25.6 : 1	5.6°	12.6 : 1	12.6 : 1
3.4º	26.9 : 1	24.5 : 1	5.7°	12.3 : 1	12.3 : 1
3.5º	25.5 : 1	23.5 : 1	5.8°	12.0 : 1	12.0 : 1
3.6º	24.3 : 1	22.6 : 1	5.9°	11.7 : 1	11.8.: 1
3.7º	23.3 : 1	21.7 : 1	6.0°	11.4 : 1	11.6 : 1
3.8º	22.3 : 1	20.9 : 1	6.1°	11.2 : 1	11.3 : 1
3.9º	21.3 : 1	20.2 : 1	6.2°	10.9 : 1	11.1 : 1
4.0º	20.5 : 1	19.5 : 1	6.3°	10.7 : 1	10.9 : 1
4.1°	19.7 : 1	18.7 : 1	6.4°	10.5 : 1	10.7 : 1

Table 3-5. Military Standard MMLS Precision Landing Minimums.

<table>
<tr><th colspan="2" rowspan="3">GLIDEPATH ANGLE
(WITH APPROACH LIGHT CONFIGURATION)</th><th rowspan="3">MINIMUM DH</th><th colspan="4">APPROACH CATEGORY</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D & E</th></tr>
<tr><th colspan="4">MINIMUM VISIBILITY</th></tr>
<tr><td rowspan="3">2.50° - 3.10°</td><td>*</td><td>200</td><td colspan="4">3/4 4000</td></tr>
<tr><td>#</td><td>200</td><td colspan="4">1/2 2400</td></tr>
<tr><td>$</td><td>200</td><td colspan="4">1800</td></tr>
<tr><td rowspan="6">3.11° - 3.30°</td><td>*</td><td>200</td><td colspan="2">3/4 4000</td><td colspan="2">N/A</td></tr>
<tr><td>*</td><td>250</td><td colspan="2">3/4 4000</td><td>1 5000</td><td>N/A</td></tr>
<tr><td>#</td><td>200</td><td colspan="2">1/2 2400</td><td colspan="2">N/A</td></tr>
<tr><td>#</td><td>250</td><td colspan="2">1/2 2400</td><td>3/4 4000</td><td>N/A</td></tr>
<tr><td>$</td><td>200</td><td colspan="2">1800</td><td colspan="2">N/A</td></tr>
<tr><td>$</td><td>250</td><td colspan="2">1800</td><td>1/2 2400</td><td>N/A</td></tr>
<tr><td rowspan="6">3.31° - 3.60°</td><td>*</td><td>200</td><td colspan="2">3/4 4000</td><td colspan="2">N/A</td></tr>
<tr><td>*</td><td>270</td><td colspan="2">3/4 4000</td><td>1 5000</td><td>N/A</td></tr>
<tr><td>#</td><td>200</td><td colspan="2">1/2 2400</td><td colspan="2">N/A</td></tr>
<tr><td>#</td><td>270</td><td colspan="2">1/2 2400</td><td>3/4 4000</td><td>N/A</td></tr>
<tr><td>$</td><td>200</td><td colspan="2">2000</td><td colspan="2">N/A</td></tr>
<tr><td>$</td><td>270</td><td colspan="2">2000</td><td>1/2 2600</td><td>N/A</td></tr>
<tr><td rowspan="2">3.61° - 3.80°</td><td>*</td><td>200</td><td colspan="2">3/4 4000</td><td colspan="2">N/A</td></tr>
<tr><td>#</td><td>200</td><td colspan="2">1/2 2400</td><td colspan="2">N/A</td></tr>
<tr><td rowspan="4">3.81° - 4.20°</td><td>*</td><td>200</td><td>3/4 4000</td><td colspan="3">N/A</td></tr>
<tr><td>*</td><td>250</td><td>3/4 4000</td><td>1 5000</td><td colspan="2">N/A</td></tr>
<tr><td>#</td><td>200</td><td>1/2 2400</td><td colspan="3">N/A</td></tr>
<tr><td>#</td><td>250</td><td>1/2 2400</td><td>3/4 4000</td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2">4.21° - 5.00°</td><td>*</td><td>250</td><td>3/4 4000</td><td colspan="3">N/A</td></tr>
<tr><td>#</td><td>250</td><td>1/2 2400</td><td colspan="3">N/A</td></tr>
<tr><td rowspan="2">5.01° - 5.70°</td><td>*</td><td>300</td><td>1 5000</td><td colspan="3">N/A</td></tr>
<tr><td>#</td><td>300</td><td>3/4 4000</td><td colspan="3">N/A</td></tr>
<tr><td rowspan="2">5.71° - 6.40°</td><td>*</td><td>350</td><td>1 1/4</td><td colspan="3">N/A</td></tr>
<tr><td>#</td><td>350</td><td>1 5000</td><td colspan="3">N/A</td></tr>
</table>

* = No Light
$ = # Plus TDZ/CL Lights
# = MALSR, SSALR, ALSF
N/A = Not Authorized

NOTES:
1. For a HAT higher than the minimum, the visibility (prior to applying credit for lights) shall equal the distance MAP to threshold, or: (a) 3/4 mile up to 5.00° or, (b) 1 mile 5.01 through 5.70 or, (c) 1 1/4 mile 5.71 through 6.40; whichever is the greater.
2. Glideslope angles greater than 3.60° require a waiver.

3.28. Special Aircrew Training. Certain instrument procedures will require a caveat stating: " Special Aircrew Certification Required" or "Special Aircrew and Aircraft Certification Required." This applies to ASLAR procedures, CAT II/III ILS procedures, and as required in FAA directives on some host nation procedures. Unique procedures that ***do not*** fall into one of the three areas listed above, and require one of the caveats listed, shall not be published in the DoD FLIP; i.e., a unique instrument procedure that has been developed requiring "special aircrew training" and is not an ASLAR or CAT II ILS procedure, or required by an FAA directive. This type of procedure will be controlled by the developing unit/MAJCOM and published "loose-leaf' only. ***NOTE:*** Except for ASLAR and CAT II/II procedures (these requirements are already covered in AF and MAJCOM flying directives), the unit/MAJCOM responsible for the procedure will be the point of contact for addressing these special training/aircraft requirements and a method to contact the unit/MAJCOM annotated on the procedure.

Chapter 4

TERPS ANCILLARY PROGRAMS

4.1. TERPS Training:

4.1.1. Units with a TERPS responsibility will ensure continuity of TERPS expertise. Selection of an alternate TERPS specialist is encouraged. They should be equally knowledgeable and involved in the unit's TERPS activities.

4.1.2. MAJCOMs manage TERPS course E30ZR13B4A-000 quotas according to AFCAT 36-2223. This course is mandatory prior to assignment as a TERPS specialist.

NOTE: Recommend that personnel being assigned to a MAJCOM TERPS position have at least 3 years TERPS experience prior to assignment.

4.1.3. HQ AFFSA recommends the ANG ATC technicians complete the formal TERPS course in residence and maintain a working knowledge of TERPS. Request formal schooling through the Unit Training Manager and forward it, through appropriate channels, to ANG/ MPTES.

4.1.4. HQ AFFSA/XOIP manages TERPS course E30ZR13B4A 000 curriculum items. These items will constitute the STS for this course.

4.1.5. The unit primary TERPS NCO will provide training for the alternate TERPS NCO(s). A qualified TERPS specialist (not the trainer) who is also a task certifier, must task certify the trainee. If a qualified TERPS specialist is not available, the MAJCOM becomes the OJT task certifier. The primary TERPS NCO should involve alternate TERPS NCO(s) in projects to ensure proficiency and project continuity.

4.2. TERPS Automation:

4.2.1. AF Forms 3628, ***TERPS Automation Data Summary*****,** and 3629, ***Obstruction Data***:

4.2.1.1. Submission:

4.2.1.1.1. Each unit with an air traffic control function shall submit an AF Form 3628 and AF Form 3629 to their MAJCOM.

4.2.1.1.2. Retain original forms at the unit.

4.2.1.2. Database Development and Verification:

4.2.1.2.1. Use the most accurate data available. Minimum standards for distances, bearings, and geographical coordinates are at (A5.1).

4.2.1.2.2. Airfield and Navaid information collected for AF Forms 3628 and 3629 must agree with the source data (FAA Form 8240-22, ***Facility Data Sheets***, maps, civil engineering maps, etc.). If any doubt exists as to the accuracy of the source data (example: contradictory data on CE maps), request a survey to validate the data. MAJCOM TERPS is OPR for initiating survey requests. Additional information can be obtained by referring to AFI 14-205, *Identifying Requirements for Obtaining and Using Cartographic and Geodetic Products and Services.*

4.2.1.2.3. MAJCOMs shall review AF Form 3628 and 3629 for accuracy by comparing them against the facility data sheets and master maps.

4.2.1.2.4. AF Form 3628 and 3629 will be entered into the TERPS automation system. Afterwards, a database printout will be sent to the unit to verify entered data.

NOTE: The accuracy of the information on these forms and subsequent printouts bears directly on the accuracy of your automated instrument procedures.

4.2.1.2.5. Document discrepancies on the printouts and send to the MAJCOM TERPS office for correction within 45 days of preparation date on the database printout.

4.2.1.2.6. If no discrepancies exist on printouts, the unit will advise the MAJCOMTERPS office. MAJCOM TERPS office will forward a copy of Location/Obstacle database to HQ AFFSA/XOIP. Consider the printout accurate and use in lieu of "original" AF Forms 3628 and 3629 as the unit's official airfield document. The original AF Forms 3628 and 3629 will remain on file at the unit for historical purposes. Changes to airfield/obstacle data will be reflected on the printout. Notify the MAJCOM TERPS office in writing as soon as you become aware of a change to data on the forms (for example, Subject: Revision #2 to AF Forms 3628 and 3629 printout dated October 15, 1991). Identify all changes on a cover letter and/or highlighted on the revised printout.

4.2.1.2.7. Make requests for additional database printouts/disks to the automating agency.

4.2.1.3. Verify database printouts/disks annually. Establish annual verification procedures in each MAJCOM supplement.

4.2.2. **Automation Master Obstruction Maps and CE Maps:**

4.2.2.1. Each unit with a TERPS function will develop and maintain a set of master maps/CE maps which identify all obstacles listed on the latest AF Form 3629 printout. Use these maps/CE maps to verify controlling obstacles for each segment of the instrument procedure (see attachment 5 for development instructions). ***NOTE:*** When using the AFTERPS DTED/DVOF obstacle search method, master obstruction maps (except for CE Maps) are not required. However, a current

set of (CHUM'd) maps covering the entire DTED/DVOF obstacle search area, shall be maintained and used for each procedure validation (overlaying procedure acetates to confirm correct controlling obstacle has been identified).
4.2.2.2. Each unit will supply their MAJCOM TERPS function with a duplicate set of master maps. MAJCOMs **may** require engineering maps to accompany the master maps.
4.2.3. **Reviewing and Processing Automated Procedure Packages:**
4.2.3.1. **Unit TERPS Responsibilities:**
4.2.3.1.1. Units without automation capability (Units in this category will provide written explanation, to the MAJCOM, of the reason(s) they cannot accomplish their own TERPS automation, and their intentions to resolve the issue).
4.2.3.1.1.1. Request automated package from MAJCOM TERPS using AF Form 3630, ***TERPS Automation Request***.
4.2.3.1.1.2. Upon receipt of automated package, process according to paragraph 4.2.3.2.
4.2.3.1.2. Units with automation capability.
4.2.3.1.2.1. Develop procedure using TERPS micro-program.
4.2.3.1.2.2. Review and take appropriate action on procedural changes indicated by automation.
4.2.3.1.2.3. Submit computer printouts of all input/output data from micro-program including AF Form 3644 and AF Form 3638 to MAJCOM TERPS.
4.2.3.2. **Package Validation:**
4.2.3.2.1. Verify controlling obstacle information for each segment of the IAP using acetate overlays. If any other obstacle is suspected of being the controlling obstacle, check it using manual calculations. If an obstacle not listed in the AF Form 3629 is identified as the controlling obstacle, enter the obstacle into the data base, and re-automate the procedure.
4.2.3.2.2. Verify course, individual IAP segments, holding patterns, etc., do not interfere with special use airspace, noise abatement areas, airways, restricted areas, etc.
4.2.3.2.3. Verify NAVAID and or radar coverage restrictions do not affect the procedure.
4.2.3.2.4. Check all courses and fixes for correct alignment and positioning.
4.2.3.2.5. Coordinate any procedure alterations with the automating agency.
4.2.3.2.6. Complete appropriate forms and obtain signatures, flyability check, etc.
4.2.3.2.7. Forward the automated package to the appropriate reviewing agencies as outlined in figure 2.1 or figure 2.2.
4.2.3.3. **MAJCOM TERPS Office Responsibilities** (automating agency).
4.2.3.3.1. Review the automated package upon return from the unit.
4.2.3.3.2. Return the original package to the unit on completion of review and process IAW Chapter 2 for appropriate publication (FLIP, loose-leaf, etc.).
4.2.4. AF Form 3630, ***TERPS Automation Request.*** Make requests for automation assistance directly to the responsible MAJCOM. Submit information on AF Form 3630. If an urgency exists for developing a procedure, transmit the information via message and a follow-up AF Form 3630 sent for documentation purposes.

4.3. Automated Package Contents:
4.3.1. Use computer printouts instead of computation sheets. Use acetate overlays in lieu of map drawings unless automation cannot build the segments.
4.3.2. The unit will provide one copy of common procedure segments, (circling and MSA). Locally reproduce these drawings for inclusion in each package.
4.3.3. Process automated packages according to paragraph 2.3.2.

4.4. AFTERPS Hardware Requirements.
4.4.1. A Pentium, 166 MHz, 32 MB of RAM, 2MB VRAM, 2 GB Hard Drive, 6x CD ROM, Super VGA 17" Monitor, and a 600 dpi or higher Laser Printer.
NOTE: A Pentium, 200 Mhz, 64 MB of RAM, and 8X Speed CD ROM is highly recommended. A scanner will also be required for future applications.

4.5. Forms Prescribed. The following forms are prescribed in this manual:
AF Form 3628, TERPS Automation Data Summary
AF Form 3629, Obstruction Data
AF Form 3630, TERPS Automation Request
AF Form 3632, Minimum Vectoring Altitude Chart (MVA)
AF Form 3633, Minimum Vectoring Altitude Computations
AF Form 3634, Departure Route/Standard Instrument Departure
AF Form 3635, Application of Departure Route Criteria
AF Form 3636, Application of Diverse Departure Criteria
AF Form 3637, Instrument Approach Procedures
AF Form 3639, Precision Computations

AF Form 3640, Nonprecision Computations
AF Form 3641, VDP Computations Worksheet
AF Form 3642, Circling Computations
AF Form 3979, MMLS TERPS Computations
AF Form 3980, Instrument Procedure Waiver
AF Form 3981, GPS/RNAV Descent Angle and Surface Evaluation
AF Form 3982, GPS/RNAV Combination Straight and turning Missed Approach Length of Section
AF Form 3992, Instrument Procedure Flyability Check, Instrument Approach Procedure (IAP)
AF Form 3993, Instrument Procedure Flyability Check, Standard Instrument Departure Procedure (SID)

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GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

NOTE: The Following publications are required in the TERPS work area. In some cases, publications listed as "must be accessible within the Air Traffic Control Operation", may be required in the TERPS work area. For example, if your location is equipped with MLS, you would be required to have FAAO 8260.36 in the TERPS Office. At overseas locations, MAJCOMs may determine which appropriate FAA publications are required in the TERPS work area. If an electronic means (CD-ROM, via LAN, etc.) is available to access these publications, paper copies are not required to be maintained in the TERPS office.

AFI 11-201	Flight Information Publications
AFI 11-206	General Flight Rules
AFMAN 11-217	Instrument Flying Procedures
AFI 13-201	Air Force Airspace Management
AFI 13-203	Air Traffic Control
AFMAN 13-215	ATC Radar Maps and Associated Systems
AFJMAN 11-225	Flight Inspection Manual (FAAO 8200.1)
AFJMAN 11-226	U.S. Standard for Terminal Instrument Procedures (FAAO 8260.3)
AFMAN 11-230	Instrument Procedures
AFI 14-205	Identifying Requirements for Obtaining and Using Cartographic and Geodetic Products and Services
AFJMAN 32-1013	Airfield and Heliport Planning and Design Criteria (Old AFR 86-5 & 86-14)
AFI 32-1026	Planning and Design of Airfields
AFI 32-1042	Standards for Marking Airfields
AFI 32-1044	Visual Air Navigation Systems
AFI 32-7061	Environmental Impact Analysis Process
AFI 32-7062	Air Force Comprehensive Planning
AFI 32-7063	Air Installation Compatible Use Zone Program
FAAO 7100.8	Standard Instrument Departure (SID)
FAAO 7100.9	Standard Terminal Arrival (STAR)
FAAH 7130.3	Holding Pattern Criteria
FAAO 7400.2	Procedures for Handling Airspace Matters
FAAO 7400.8	Special Use Airspace
FAAO 7400.9	Airspace Designations and Reporting Points
FAAO 8200.38	Flight Inspection of Global Positioning System (GPS)
FAAO 8240.32	Request for Flight Inspection Services
FAAO 8240.36	Instructions for Flight Inspection Reporting
FAAO 8240.47	Determination of Instrument Landing System (ILS) Glidepath Angle, Reference Datum Heights (RDH)
FAAO 8260.19	Flight Procedures and Airspace
FAAO 8260.32	U.S. Air Force Terminal Instrument Procedures Service
FAAO 8260.38	Civil Utilization of Global Positioning System

The following National Imagery and Mapping Agency publications are required:
National Imagery and Mapping Agency Catalog of Maps, Charts, and Related Products
FLIP General Planning Guide
FLIP Area Planning (AP1, AP2, AP3, or AP4 as applicable)
Complete set of FLIPs as applicable to facility)

NOTE: The following publications must be ***accessible*** within the Air Traffic Control operation.

AFI 13-213	Airfield Management
AFMAN 13-214	Aircraft Surge Launch and Recovery Operations
AFI 37-126	Management of Records
AFI 37-138	Records Disposition Procedures and Responsibilities
AFMAN 37-13	Disposition of Air Force Records
FAA AC 0031	U.S. National Aviation Standard for the VOR/DME/TACAN Systems
FAAH 7350.6	Location Identifiers
FAAH 7610.4	Special Military Operations
FAAO 7930.2	Notice to Airman (NOTAM)

FAAO 8260.36	Civil Utilization of Microwave Landing System
AIM	Aeronautical Information Manual
FAR PART 71	Designation of Federal Airways, Area Low Routes, Controlled Airspace, and Reporting Points
FAR PART 73	Special Use Airspace
FAR PART 77	Objects Affecting Navigable Airspace
FAR PART 93	Special Air Traffic Rules and Airport Traffic Patterns
FAR PART 95	IFR Altitudes
FAR PART 97	Standard Instrument Approach Procedures

NOTE: The following publications are available for reference.

FAA AC 70/7460-2	Proposed Construction or Alteration of Objects That May Affect The Navigable Airspace
FAAO 6000.1	Certification and Operation of Military-Maintained Air Navigation Facilities in the NAS
FAAO 8260.23	Calculation of Radio Altimeter Height
FAAO 8260.31	Foreign Terminal Instrument Procedures
FAAO 8260.40	Flight Management System (FMS) Instrument Procedure Development
FAAO 8260.41	Obstacle Assessment surface evaluation for Independent Simultaneous Parallel Precision Operations

Abbreviations and Acronyms

AFRES	Air Force Reserve
AFFSA	Air Force Flight Standards Agency
AICUZ	Air Installation Compatible Use Zone
AIP	Aeronautical Information Publication
ALS	Approach Lighting System
AMIS	(FAA) Aircraft Management Information System
ANG	Air National Guard
APATC	Criteria for the Preparation of Instrument Approach and Departure Procedures
ARA	Airborne Radar Approach
ASLAR	Aircraft Surge Launch and Recovery
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
CHUM	Chart Updating Manual
DA	Decision Altitude
DECEL	Deceleration
DER	Departure End of Runway
DH	Decision Height
DME	Distance Measuring Equipment
DoD	Department of Defense
DR	Dead Reckoning
DVOF	Digital Vertical Obstruction File
ECHUM	Electronic Chart Updating Manual
ESV	Expanded Service Volume
FAA	Federal Aviation Administration
FAAH	Federal Aviation Administration Handbook
FAC	Final Approach Course
FAF	Final Approach Fix
FAS	Final Approach Speed
FIO	Flight Inspection Office
FLIP	Flight Information Publications
FMS	Flight Management System
FTF	Fix-To-Fix
GPS	Global Positioning System
GS	Glide Slope
HAT	Height Above Touchdown
HAA	Height Above Airport
IACC	Interagency Air Cartographic Committee
IAF	Initial Approach Fix

IF	Intermediate Fix
IFIO	International Flight Inspection Office
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
KIAS	Knots Indicated Airspeed
MAJCOM	Major Command
MAP	Missed Approach Point
MDA	Minimum Descent Altitude
MIFRAC	Minimum IFR Altitude Chart
MLS	Microwave Landing System
MMLS	Mobile Microwave Landing System
MSA	Minimum Safe Altitude
MSL	Mean Sea Level
MVAC	Minimum Vectoring Altitude Chart
NAVAIDs	Navigational Aids
NATO	North Atlantic Treaty Organization
NIMA	National Imagery and Mapping Agency
NM	Nautical Mile
OIS	Obstacle Identification Surface
PAR	Precision Approach Radar
PCG	Positive Course Guidance
PV	Prevailing Visibility
RNAV	Area Navigation
RVR	Runway Visual Range
SID	Standard Instrument Departure
SM	Statute Mile
SSM	Side-Step Maneuver
STAR	Standard Terminal Arrival Route
TACAN	Tactical Air Navigation
TDZ	Touchdown Zone
TERPS	Terminal Instrument Procedures
VDP	Visual Descent Point
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omni-Directional Range Station

Terms

NOTE: For additional terms, refer to the glossaries in AFJMAN 11-226, Handbook FAAH 7110.65 *and Flight Information Publication (FLIP)*, General Planning.

Air Force Flight Standards Agency (AFFSA)--Responsible for the day-to-day management of the USAF Terminal Instrument Procedure Program.

Automating Agency--Unit/MAJCOM TERPS office responsible for automating an instrument procedure.

Final Approval Authority--Standard Instrument Procedure (SIP)--Designated individual or agency that guarantees a SIP meets all criteria as stipulated in AFJMAN 11-226, NATO APATC-1, and other applicable directives. This authority also ensures the procedure package is complete as outlined in paragraph 2.3.2 of this manual.

Flight Inspection--An inspection conducted in accordance with AFJMAN 11-225, *US Standard Flight Inspection Manual* or ICAO Annex 10, Volume I, Part I, *Equipment and Systems.* This inspection also includes a check for flyability of the instrument procedure.

FLIP Maintenance--Systematic procedure used by Unit and/or MAJCOM TERPS for tracking and updating instrument procedures.

Flyability Check--An in-flight check normally accomplished by flying unit requesting the procedure to determine if a procedure is operationally acceptable.

High Altitude Instrument Procedure--Terminal instrument procedure that usually begins (approach) or ends (departure) at or above 18,000 feet mean sea level (MSL).

Low Altitude Instrument Procedure--Terminal instrument procedure that usually begins (approach) or ends (departure) below 18,000 feet MSL.

Nonstandard Procedure--Procedure that deviates from the criteria or requirements of this manual, AFJMAN 11-226, NATO APATC-1 and any approved supplements.

Procedure Package--Documentation used to develop, revise, and approve instrument procedures. Examples of documents include maps, charts, automated products, computation sheets, and host nation aeronautical information publications (AIP).

Public-Use Procedure--Procedure that may be used by any agency or person.

Restricted-Use Procedure--Procedure limited in use; USAF ONLY or NOT FOR CIVIL USE.

Segment Review--A process in which properly constructed TERPS areas and/or any other areas associated with the procedure are evaluated to ensure proper obstacle clearance.

Special Use Procedure--Operational required procedure that is not published in FLIP.

Standard Procedure--Procedure conforming with the criteria and requirements of this manual, AFJMAN 11-226 or NATO APATC-1 and any approved supplements.

Terminal Instrument Procedure--Any procedure designed for instrument approach or departure of aircraft to or from an airport or point in space (for example, non-precision and precision approaches and standard instrument departures).

EQUIVALENT REPORTABLE WEATHER VALUES
(Source: FMH-No. 1)

CEILING

FEET	METERS
100	30
200	60
300	90
400	120
500	150
600	180
700	210
800	240
900	270
1,000	300
1,100	330
1,200	360
1,300	390
1,400	420
1,500	450
1,600	480
1,700	510
1,800	540
1,900	570
2,000	600
2,100	630
2,200	660
2,300	690
2,400	720
2,500	750
2,600	780
2,700	810
2,800	840
2,900	870
3,000	900
3,100	930
3,200	960
3,300	990
3,400	1,020
3,500	1,050
3,600	1,080
3,700	1,110
3,800	1,140
3,900	1,170
4,000	1,200
4,100	1,230
4,200	1,260
4,300	1,290
4,400	1,320
4,500	1,350
4,600	1,380
4,700	1,410
4,800	1,440
4,900	1,470
>5000 but <10,000	Nearest 500’
>10,000 Nearest 1000’	

RVR

FEET	METERS
600	180
800	240
1,000	300
1,200	360
1,400	420
1,600	490
1,800	550
2,000	610
2,200	670
2,400	730
2,600	790
2,800	850
3,000	910
3,200	970
3,400	1,030
3,500	1,070
3,600	1,100
3,800	1,160
4,000	1,220
4,500	1,370
5,000	1,520
5,500	1,670
6,000	1,830

PREVAILING VISIBILITY (PV)

SSM	METERS
1/8	200
1/4	400
3/8	600
1/2	800
5/8	1,000
3/4	1,200
7/8	1,400
1	1,600
1 1/8	1,800
1 1/4	2,000
1 3/8	2,200
1 1/2	2,400
1 5/8	2,600
1 3/4	2,800
1 7/8	3,000
2	3,200
2 1/4	3,600
2 1/2	4,000
2 5/8	4200
2 3/4	4,400
2 7/8	4,600
3	4,800
4	6,000
5	8,000
6	9,000
7 and above	9,999

INSTRUMENT PROCEDURE CRITERIA

NOTE: This attachment clarifies and expands criteria that are not complete or are open to interpretation in AFJMAN 11-226 and *NATO Allied Publication Air Traffic Control-1 (APATC-1), Criteria for the Preparation of Instrument Approach and Departure Procedures*. Use this attachment with AFJMAN 11-226 and APATC-1. If there is any conflict between this and the TERPS documents, the criteria here govern.

A3.1. AFJMAN 11-226, paragraph 5c (Circling). Circling procedures shall not be designed for use with Precision IAPs.
NOTE: Circling procedures are appropriate when localizer minima are authorized. (See AFMAN 11-217, Chapter 15, *Circling Approaches*, for aircrew guidance.)

A3.2. AFJMAN 11-226, paragraph 141 (Nonstandard Procedures). Process waivers for military procedures according to this manual.

A3.3. AFJMAN 11-226, paragraph 142 (Changes). Process all nonprocedural changes according to FLIP GP, chapter 11; providing an information copy to MAJCOM TERPS office. Process procedural changes through channels per paragraph 2.7 in the basic text.

A3.4. AFJMAN 11-226, paragraph 150d (Coordinating Airspace Action). Ensure all instrument procedures are within controlled airspace in the United States and where required by host nation regulations. The following criteria apply:
A3.4.1. Altitudes or heights established must be at least 300 feet above the floor of Class E Airspace, except that these altitudes or heights may be rounded to the nearest 100 feet. Outside the United States, procedures must be contained within controlled airspace according to host nation criteria.
A3.4.2. Outside of Class D airspace (and extensions) and Class E airspace, use air traffic control IFR lateral separation standards. (See FAAH 7110.65, chapters 5 and 6)
A3.4.3. In Class D airspace (and extensions) and Class E airspace, use the criteria in FAAH 7400.2 and FAAO 8260.19, or the TERPS primary obstacle clearance area, whichever is greater.
A3.4.4. Ensure Instrument Approach Procedures which contain Category E Circling Minimums remain within the confines of Class D/E Surface Areas and/or extensions.
NOTE: AFI 13-201, *Airspace Management*, contains procedures for processing airspace actions.

A3.5. AFJMAN 11-226, paragraph 161 (Straight-In Procedure Identification). An approach name with a slash (/) between equipment identifiers (i.e., ILS/DME Rwy 31) requires the aircraft to be both ILS and DME equipped to fly the procedure. However, the designation DME/RADAR on the profile view of a procedure is intended to allow an aircraft with only ILS (NO DME) to fly the approach with ATC RADAR available to assist the aircraft in identifying the FAF. The procedure should therefore be named without DME (i.e., ILS Rwy 31). NOTE: If DME and RADAR identify the FAF, add "RADAR OR DME REQUIRED" in the plan view of the procedure. This applies to any equipment required (i.e., ADF OR DME REQUIRED, ADF OR RADAR REQUIRED, etc.).

A3.6. AFJMAN 11-226, paragraph 163. (Differentiation). At USAF locations where both high and low altitude instrument approach/departure procedure are published in the same DoD FLIP, a procedure can be identified as a HI/LO procedure, e.g., HI/LO TACAN or VOR/DME Rwy 36. The procedure will be cross-hatched along the upper left half of the top border and along the lower right half of the bottom border. The procedure will contain Category A-E minimums.

A3.7. AFJMAN 11-226, paragraph 221 (Minimum Safe Altitudes). Comply with this paragraph but note that the navigation facility on which a procedure is based may not always provide the pilot with the most useful origin for the MSA. If more useful information can be obtained from a facility other than the one on which the procedure is based, use that facility provided it is within 30 miles of the airport. This will only be accomplished after the procedure specialist has coordinated with all concerned agencies.

A3.8. AFJMAN 11-226, paragraph 232a[2] and Table 1 (Initial Approach Segments Based on Straight Course and Arcs With Positive Course Guidance). When a 15 NM arc is used, the OPTIMUM descent gradient is 800 feet per nautical mile.

A3.9. AFJMAN 11-226, paragraphs 250, 413a[1], 423a 513a[1][a], 513a[2][a], 613a[1], 623a, 713a[1][a], 713a[2][a], 813a, and 1413a[1] (The angle between the FAC and the runway centerline must not exceed 30 degrees). The FAC should cross the runway centerline at a point 3000 feet outward from the threshold; however, it may cross the runway centerline at any point provided it lies within 500 feet of the centerline at a point 3000 feet outward from the threshold.

A3.10. AFJMAN 11-226, paragraph 251 (Visual Portion of the Final Approach Segment) . Use the criteria but:
A3.10.1. With the exception of ASR approaches, establish a VDP for all non-precision procedures. ***NOTE:*** Procedures outside CONUS (i.e., Host Nation procedures and military bases applying APATC-1 criteria), exceptions may apply.
A3.10.1.1. A VDP will be a DME fix, established prior to the MAP, when a suitable navigation fix is available.
A3.10.1.2. When obstacles that cannot be removed penetrate the VDP surface, raise the surface and corresponding visual GS or descent gradient to eliminate the penetration. When a penetration remains, a VDP will not be published.
A3.10.1.3. When dual MDAs exist, publish only one VDP, based on the lowest MDA on the procedure, provided both VDP descent gradients are within limits. If a visual guidance system (i.e., VASI, PLASI, etc.) is installed to a non-precision runway, establish the VDP where the systems angle meets the lower MDA.
A3.10.1.4. A VDP fix can be less than one mile from a step-down fix or missed approach point, provided chart clarity is not compromised.
A3.10.1.5. When a VDP is not published, document the reason in the procedure package.
A3.10.2. The following criteria is to be used for the determination of VDPs when using the PAPI system.
A3.10.2.1. Where PAPI is installed, the VDP shall be located where the visual on glide path guidance intersects the lowest minimum descent altitude (MDA).
A3.10.2.2. Area. the VDP area is determined as follows:
A3.10.2.2.1. The area shall begin at a point 300 feet in front of the PAPI system (toward the threshold) and splay + or - 10° either side of the runway centerline.
A3.10.2.2.2. Where the + or - 10° splay does not encompass the width of the runway at the threshold, the area shall begin at the threshold at the same width as the runway and splay 10 degrees from the runway edges.
A3.9.2.2.3. The area shall terminate at the VDP or where the obstacle clearance surface elevation is equal to the MDA minus the required obstacle clearance (ROC), whichever occurs first. This area will not extend more than 4 statute miles from its origin.
A3.10.2.2.4. The VDP surface begins 300 feet in front of the PAPI system and proceeds outward into the approach zone at an angle 1.2° less than the aiming angle of the PAPI. The surface extends 10° on either side of the runway centerline extended, and may extend as much as 4 statute miles from its point of origin.
A3.10.2.2.5. No obstacle shall penetrate the surface overlying the area associated with the VDP. If it is determined that an obstacle will penetrate the surface and it cannot be removed, the glidepath angle of the PAPI must be changed or the system moved further from the threshold.
A3.10.3. The following criteria are to be used for the determination of VDPs in conjunction with the PLASI system:
A3.10.3.l. Where PLASI is installed, the VDP shall be located at the point where the visual on glide slope signal intersects the lowest minimum descent altitude (MDA).
A3.10.3.2. Area. The VDP area is determined as follows:
A3.10.3.2.1. The area shall begin at a point 300 feet in front of the PLASI system (closer to the threshold) and splay + or - 8° either side of the runway centerline.
A3.10.3.2.2. Where the + or - 8° splay does not encompass the width of the runway at the threshold, the area shall begin at the threshold at a width equal to the runway width and splay 8° from the runway edges.
A3.10.3.2.3. The area shall terminate at the VDP or where the obstacle clearance surface elevation is equal to the MDA minus the required obstacle clearance (ROC), whichever occurs first. In no case will this area extend more than 4 statute miles from its origin.
A3.10.3.3. The VDP surface begins 300 feet in front of the PLASI system and proceeds outward into the approach zone at an angle 1.2° less than the aiming angle of the PLASI. The surface extends 8° on either side of the runway centerline extended, and may extend as much as 4 statute miles from its point of origin.
A3.10.3.4. No obstacle shall penetrate the surface overlying the area associated with the VDP. If it is determined there is an obstacle which penetrates the obstacle clearance surface which cannot be removed, the glidepath angle must be changed or the PLASI system moved further from the threshold.

A3.11. AFJMAN 11-226, paragraph 251c[2] (Visual Portion of the Final Approach). Additionally, when a sector is eliminated from the obstacle clearance area (e.g., "Circling NA West of Rwy 18-26") expand the obstacle clearance area within which circling is permitted to include a portion of the sector eliminated. The expanded portion of the obstacle clearance area is the VDP area boundary defined in subject paragraph.

A3.12. AFJMAN 11-226, paragraph 270 (Missed Approach Segment). In addition, remember that when developing missed approaches for PAR or ASR procedures, it is not necessary to use non-radar NAVAIDs. These radar missed approaches should be the same as normal climbout instructions, if possible, to get the aircraft back to minimum vectoring altitude for another approach or headed to an alternate airfield.

A3.13. AFJMAN 11-226, paragraph 272 (Missed Approach Point) Crossing radial may be used to define a missed approach point. This will be considered a "Non-Standard Procedure" and processed IAW paragraph 2.5. Maximum acceptable fix error is 1/2 mile for crossing radial. Fix to NAVAID distance shall not exceed 7.9 NM.

A3.14. AFJMAN 11-226, paragraph 274 (Missed Approach Segment). In addition, note that instances may occur when an obstacle penetrates the 40:1 precision or non-precision missed approach surface and other solutions (e.g., DH adjustments) are not feasible. An equivalent level of safety may be achieved by selecting a climb gradient which matches a missed approach surface that clears the obstacle. If this alternative is selected, the procedure becomes nonstandard. Required minimum climb rate information must be graphically displayed on the procedure. The altitude or fix to which the climb gradient must be maintained must be published. ***NOTE:*** A climb gradient required for Air Traffic Control purposes shall be considered nonstandard and processed IAW paragraph 2.5. (Also see AFJMAN 11-226, paragraph 141).

A3.15. AFJMAN 11-226, paragraph 282 (DME Fixes). In addition, describe in nautical miles when a "'fly-off" (level flight) is maintained from the primary facility or fix, before the beginning of the penetration or procedure turn or descent. Depict the beginning of the penetration or procedure turn or descent on the plan and profile view by associated DME values when available.

A3.16. AFJMAN 11-226, paragraph 310 (Takeoff and Landing Minimums). Do not establish or publish alternate and takeoff minima for Air Force procedures except as noted in paragraph A3.28.16. Alternate minima are given in AFI 11-206, *General Flight Rules*, and takeoff minima are prescribed by each MAJCOM.

A3.17. AFJMAN 11-226, paragraph 320 (Height Above Touchdown, HAT). In addition to the requirements of chapter 3, make sure each procedure specifies the HAT and/or height above airport (HAA). For foreign procedures, the minima must be the higher of the minima established by the host nation or required by AFJMAN 11-226 or APATC-1.

A3.18. AFJMAN 11-226, paragraph 323c (Minimums Adjustments). Excessive length of final computations do not apply to circling approach procedures.

A3.19. AFJMAN 11-226, paragraph 334c (Runway Requirement for Approval of RVR). Use RVR minima equivalent to the no-light minima when runway markings are removed, deteriorated, or obscured and touchdown zone, and centerline lights are inoperative. The airfield manager determines when these facilities are no longer adequate for taking credit for lights.

A3.20. AFJMAN 11-226, paragraph 343e (Visibility Reduction). Do not use see and avoid procedures for obstacles when developing Air Force instrument procedures.

A3.21. AFJMAN 11-226, paragraph 523b (Final Approach Segment). See supplemental paragraph A3.8 (this attachment) for allowable arc radius and descent gradient for the initial segment.

A3.22. AFJMAN 11-226, paragraph 912 (Distance Measuring Equipment, DME). Use DME or PAR to establish a fix at the Category I DH point where middle markers have been removed. A DME fix that coincides with the DH point is exempt from the six degree angular divergence criteria. This can be applied to outer markers/FAFs. The exemption is limited to 23 degrees (AFJMAN 11-226, paragraph 282) and a successful flight inspection must be accomplished to verify the suitability of the fix.

A3.23. AFJMAN 11-226, paragraph 921 (Initial Approach Segment) . Solid state ILS localizers have false courses approximately 35 degrees either side of the final approach course. To assist pilots in avoiding these courses, establish a lead point (fix or lead radial or bearing) that provides at least 2 miles of lead when any part of the initial approach course lies outside of plus or minus 10 degrees of the final approach course.

A3.24. AFJMAN 11-226, paragraph 932 (Transitional Surface). This paragraph should state, "At right angles to the final approach course". It is not possible to construct at right angles to a "point." These areas extend for a lateral distance of 5000 feet at right angles to the final approach course.

A3.25. AFJMAN 11-226, paragraph 952 (Alignment). Align localizers to meet final approach alignment criteria for VOR (no FAF), except make sure that the angle of divergence of the final approach course and the extended runway centerline does not exceed 3 degrees.

A3.26. AFJMAN 11-226, chapter 9, section 6 (ILS Category II). Use the following criteria:

A3.26.l. **Ground System Requirements:**

A3.26.1.1. **Electronic Guidance System.** This is an instrument landing system that meets Category II performance standards and provides continuous electronic guidance to the ILS Reference Datum. It consists of these elements:

A3.26.l.l.l. **Localizer.** The localizer provides azimuth guidance from the specified coverage limit down to the ILS Reference Datum.

A3.26.l.l.2. **Glide Slope.** The glide slope provides guidance in the vertical plane, from the specified coverage limit down to the ILS Reference Datum.

A3.26.l.l.3. **Very High Frequency Marker Beacons.** Each installation must have a 75 megahertz inner marker beacon. In addition, outer and middle markers are required or suitable substitutes must be available to identify these fixes. Suitable substitutes for the middle marker are PAR or DME (see AFJMAN 11-226, paragraph 912). Suitable substitutes for the outer marker are:

A3.26.1.1.3.1. Locator Beacon.

A3.26.1.1.3.2. Crossing Radials.

A3.26.1.1.3.3. Distance Measuring Equipment (DME).

A3.26.1.1.3.4. Precision Approach Radar (PAR) or Airport Surveillance Radar.

A3.26.1.2. **Visual Guidance System.** The lighting system must provide continuous visual guidance from the point where the transition begins from Category II instrument flight to visual reference. The visual system provides guidance for the approach, flare, landing, and rollout. The Category II ILS visual guidance system consists of these components:

A3.26.1.2.1. **Approach Lighting System (ALS).** Operations are authorized on the present Category I, Configuration "A," 3000 foot ALS or equivalent (AFJMAN 11-226, appendix 5). A negative gradient is not permitted in the inner 1500 feet.

A3.26.1.2.2. **Touchdown Zone and Centerline Lighting System.** The runway must have a lighting system that conforms to the criteria in AFI 32-1044.

A3.26.1.2.3. **High Intensity Runway Edge Lighting.** The runway must have a high intensity lighting system that defines the lateral and longitudinal limits of the runway and conforms to the criteria in AFI 32-1044.

A3.26.1.2.4. **All-Weather Runway Markings.** The runway must have all-weather runway markings as specified in AFI 32-1042. ***NOTE:*** Where runway markings are obscured by snow, ice, and other weather phenomena, assessment shall be made by the senior operational commander to determine if CAT II ILS operations may continue. Every effort shall be made to remove the obstruction.

A3.26.1.3. **Runway Visual Range (RVR):**

A3.26.1.3.1. For operations below 1600 RVR, two transmissometers are required to provide RVR information at the approach and rollout ends of the Category II runway. Also, automatic digital readout equipment for RVR must be installed in the control tower and radar facilities. When transmissometers are first installed on a Category II runway, both transmissometers will be installed on a 250-foot baseline. Where a Category I runway is updated to Category II status, the touchdown zone transmissometer may be on a 500-or 250-foot baseline. To provide service at the rollout end of the Category II runway the transmissometer must be installed on a 250-foot baseline.

A3.26.1.3.2. Transmissometers serving other runways may be used to provide RVR information at the rollout end of the Category II runway. In this case, the transmissometer will be located within a radius of 2000 feet of the rollout threshold of the Category II runway, and cover at least 2000 feet of the Category II rollout area, as measured from the rollout threshold.

A3.26.1.4. **Radar (Radio) Altimeter Setting Heights.** The vertical distance at the 100 or 150 foot (or other) decision heights between the glide slope and the terrain beneath these points, on the extended runway centerline, must be completed (See FAAO 8260.23 for computations).

A3.26.1.5. **Remote Monitoring.** There must be remote monitoring for the glide slope, localizer, and marker beacons of the Category II ILS system.

A3.26.1.6. **Manual Inspection.** Because the following systems are not remotely monitored, they must be inspected frequently by airfield management officials, or verified by frequent pilot reports, to ensure they are operating properly.

A3.26.1.6.1. Touchdown Zone and Centerline Lights.

A3.26.1.6.2. Runway Edge Lights.

A3.26.1.6.3. Runway Markings.

A3.26.1.6.4. Approach Lighting System.

A3.26.1.7. **Approach Light System.** The approach lights must have two power sources configured to provide a one-second or less changeover capability between sources.

A3.26.2. **Critical Areas.** See AFI 13-203 and FAAH 7110.65 for critical area dimensions and ATC procedures and AFI 32-1042 for required markings.

A3.26.3. **Obstacle Clearance Criteria.** For the final and missed approach areas used in formulating ILS Category II procedures, obstacle clearance criteria are as follows:

A3.26.3.1. **Final Approach Segment.** Comply with AFJMAN 11-226, paragraph 930.

A3.26.3.2. **Final Approach Obstacle Clearance Surface.** The final approach surface is an inclined plane that starts at the runway threshold elevation, 200 feet outward from the threshold, and overlies the final approach area. The surface is divided into two sections: an inner 10000-foot section and an outer 40000-foot section. The slope changes at the 10000-foot point. Although the precise gradient may differ with the angle of the glide slope, the 50:l and 40:l slopes (that apply to the 2 1/2-degree glide slope) must be used unless other slope ratios are required to ensure the proper obstacle clearance (see table A3.1 for slopes that provide the minimum obstruction clearance for specific glideslope angles.)

Table A3.1. Glideslope Angle vs. Slope or Surfaces.

GS ANGLE (DEGREES)	SLOPE OF INNER SECTION	SLOPE OF OUTER SECTION
2 1/2	50:1	40:1
2 3/4	40:1	34:1
3	34:1	29.5:1

A3.26.3.3. **Final Approach Area Transitional Surfaces** (comply with AFJMAN 11-226, paragraph 932).
A3.26.3.4. **Obstruction Clearance.** No obstruction will penetrate the final approach obstacle clearance surface. When an obstruction penetrates the final approach area transitional surface, adjust the Decision Height (DH) or Decision Altitude (DA) to accommodate the degree of interference it presents.
A3.26.4. **Special Obstruction Clearance Areas.** Because the flight altitudes are lower in the immediate vicinity of the runway during ILS Category II approach and missed approach there are specific areas where obstructions must be eliminated or controlled. These are the approach light area, the touchdown area, the touchdown area transitional surfaces, and the missed approach area.
A3.26.4.1. **Approach Light Area** (figure A3.1):
A3.26.4.1.1. **Obstruction Clearance.** An obstruction must not penetrate the approach light plane unless the conditions specified in A3.26.3.4.1.1 and A3.26.3.4.1.3 are met. Also, an obstruction, including the approach light structure or fixtures, must not penetrate the approach light surface without penalty.
A3.26.4.1.2. **Raising the Approach Light Plane.** If obstacles in this area cannot be removed or lowered, raise the approach light plane, but keep the slope gradient as small as possible. (It must not exceed 2 percent for a positive slope.) The sloping segment must begin at least 200 feet from the landing threshold and must start far enough away from the obstacle so the obstacle will not penetrate the plane. If penetrations still exist after the plane is raised to 2 percent (comparable to a 50:1 slope), starting from a point 200 feet from the end of the runway threshold, the obstacles also penetrate the approach light and final approach surfaces for a 2.5 degree or lower glide path. Therefore, the minima must be adjusted accordingly.
A3.26.4.1.3. **Permissible Deviations.** Some obstacles may penetrate the approach light plane (but not the final approach or approach light surface) without penalty, They may be waived providing:
A3.26.4.1.3.1. The obstacle is needed for the effective operation of the airfield, does not obscure the approach lighting capability, can be conspicuously lighted or marked, and is frangible.
A3.26.4.1.3.2. The obstacle does not penetrate the 2 percent gradient (50:1 slope) when the slope begins at a point 200 feet out from the runway threshold.
A3.26.4.2. **Touchdown Area Obstruction Clearance.** Only objects that are needed for the effective operation of the airfield, or are required for precision approaches to the runway, are permitted in the touchdown area (figure A3.2). Each object (except visual aids and frangible functional objects) must be properly marked and lighted, unless shielded by a properly lighted and marked functional object. The identity and height limits of acceptable objects are as follows:
A3.26.4.2.1. **Visual Aids.** Unless they are flush-mounted, all visual aids will be installed on frangible mounts. The greatest height above the surface where the aid is located is 14 inches (except for runway markers and visual approach slope indicator equipment). Taxiway guidance signs may be installed according to AFM 88-14.
A3.26.4.2.2. **Glide Slope (GS) Antennas.** The antenna and monitor mast must be at least 400 feet from the ILS Category II runway centerline, and should not be more than 55 feet above the nearest point on the runway centerline. A mast of over 55 feet is permitted only when the minimum distance from the runway centerline is increased 10 feet for each foot the mast exceeds 55 feet.
A3.26.4.2.3. **Structures.** Any structure that is part of the glide slope, PAR or RVR system (except GS antenna or monitor mast) should not be more than 15 feet higher than the elevation of the runway centerline, abeam, and no closer to the runway centerline than 400 feet. However, it may be more than 15 feet high if the distance from the centerline is increased 10 feet for each foot the structure exceeds 15 feet.
A3.26.4.3. **Touchdown Area Transitional Surface Obstruction Clearance.** When an obstruction penetrates the 7:1 transitional surfaces, adjustment in the HAT and/or RVR must be made as outlined in paragraph A3.26.4.6.
A3.26.4.4. **Missed Approach Area.** The missed approach begins at the DH or DA; however, the missed approach 40:1 surface begins at the end of the touchdown zone. The area has two sections (figures A3.2, A3.3, and A3.4). Obstruction clearance is as follows:
A3.26.4.4.1. **Straight Missed Approach.** No obstruction in Sections 1 or 2 may penetrate the 40:1 surface. This surface originates at the beginning of Section 1, at the end of the touchdown zone, and overlies the entire missed approach area.

A3.26.4.4.2. **Turning Missed Approach.** Obstruction clearance for Section 1 is the same as for the straight missed approach. To determine the obstruction clearance requirements in section 2, see figures A3.3, A3.4, and A3.5.

A3.26.4.4.3. **Secondary Areas.** In the secondary area, no obstruction may penetrate a 12:1 surface which slopes outward and upward from the missed approach surface.

A3.26.4.5. **GS Angle and Threshold Crossing Height:**

A3.26.4.5.1. **GS Angle.** The maximum angle is 3.0 degrees. The minimum angle is 2.5 degrees.

A3.26.4.5.2. **GS Threshold Crossing Height.** The optimum height is 50 feet, measured at the landing threshold (see AFJMAN 11-226 for computation of TCH). The maximum height is 60 feet. A height as low as 47 feet may be used, but only when special glide path angle or antenna location is required. However, this minimum assumes that the vertical distance between the aircraft GS antenna and the lowest part of the main landing gear wheels will not exceed 27.5 feet, with the aircraft in the normal landing approach attitude.

A3.26.4.6. **Adjustment to Category II ILS Minima.** The lowest minima permitted are a HAT of 100 feet and a RVR of 1200 feet. When an object exceeds the allowable height in the touchdown zone or penetrates the approach light surface, the HAT is adjusted upward 1 foot for each foot that an obstruction exceeds the allowable height. Adjust the RVR as shown in table A3.2.

Table A3.2. RVR Adjustments.

HAT	**RVR**
101 to 140 feet	1,200
141 to 180 feet	1,600
181 to 199 feet	1,800

A3.26.4.7. **Obstruction in the Missed Approach Area.** When an object penetrates the 40:1 surface, the procedure is nonstandard, and the missed approach procedure must include:

A3.26.4.7.1. A note which specifies the feet-per-minute rate of climb required to clear the obstruction by 50 feet.

A3.26.4.7.2. The altitude, or fix, at which the climb is no longer required. For example, if an obstruction is 30000 feet from the point where the missed approach surface starts, and is 900 feet above this point, a climb gradient of approximately 190 feet per mile is required to clear this obstruction by 50 feet.

A3.27. AFJMAN 11-226 Chapter 10 Section 6, (Airborne Radar Procedures). The following special-use procedures relate to Airborne Radar Procedures and are used only by aircraft with airborne radar systems authorized by each MAJCOM headquarters. AFJMAN 11-226 applies, except as follows:

A3.27.1. **Initial Approach Segment.** AFJMAN 11-226, paragraphs 230, 231, 232, and 235 apply, except the angle of intersection between the initial and intermediate approach courses will not exceed 90 degrees. A satisfactory terminal area fix (chapter 2, section 8) may be used in addition to the ARA fix at the Initial Approach Fix (IAF) to facilitate use of enroute navigation systems up to the IAF.

A3.27.2. **Intermediate Approach Segment.** Comply with AFJMAN 11-226, paragraphs 240, 241, and 242.

A3.27.3. **Final Approach Segment.** Comply with AFJMAN 11-226, paragraph 250, except:

A3.27.3.1. **Alignment.** The final approach course will be aligned on the extended runway centerline.

A3.27.3.2. **Area.** The area considered for obstacle clearance begins at the final approach fix, ends at the runway threshold, and is centered on the final approach course. Course length must provide adequate distance for an aircraft to make the required descent. Minimum length is 6 miles, and maximum length is 10 miles.

A3.27.3.2.1. The primary area width is 1.7 miles on each side of the runway centerline at the approach end. It expands uniformly to a maximum 4 mile width on either side of the extended runway centerline (8 miles total) at a point 10 miles from the approach end of the runway.

A3.27.3.2.2. The secondary area, which is on each side of the primary, is zero miles wide at the approach end of the runway. It expands uniformly to a maximum of l mile on each side of the primary area, at a point 10 miles from the approach end of the runway.

A3.27.3.3. **Obstacle Clearance:**

A3.27.3.3.1. In the secondary area, 250 feet of obstacle clearance must be provided at the inner edge, tapering uniformly to zero at the outer edge. The minimum clearance at any point can be determined from AFJMAN 11-226, appendix 2, figure 125.

A3.27.3.4. **Descent Gradient.** The optimum gradient is 300 feet per mile. The maximum is 400 feet per mile. If a step-down fix is used, the descent gradient applies between the Final Approach Fix (FAF) and the step-down fix and between the step-down fix and the approach threshold.

A3.27.4. **Circling Approach.** AFJMAN 11-226, chapter 2, section 6, applies:

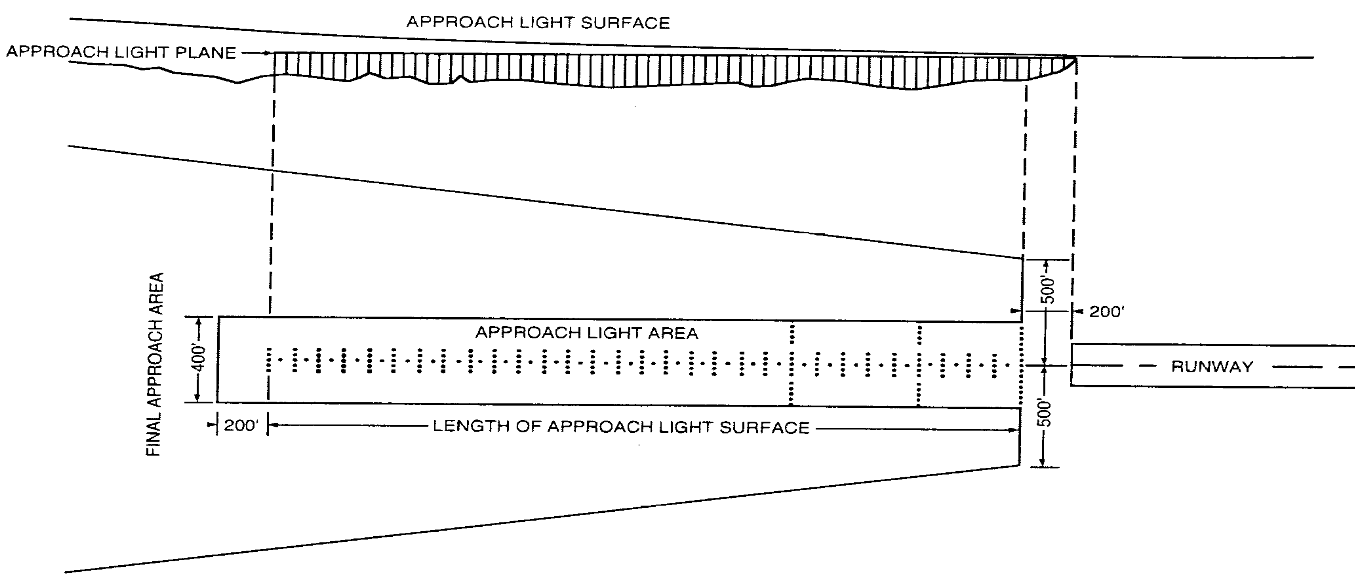
A3.27.5. **Missed Approach Segment.** AFJMAN 11-226, chapter 2, section 7, applies. The missed approach point is on the final approach course at the point where the aircraft has reached a specific radar distance from the end of the runway. It must not be farther from the FAF than the first usable portion of the landing surface.
A3.27.6. **Landing Minima.** AFJMAN 11-226, chapter 3 applies.
A3.27.7. **ARA Reflectors.** Reflector requirements are determined by equipment specifications addressed in MAJCOM flying directives. When Radar Reflectors are placed on the airfield, their locations will be depicted on the plan view of the approach procedure.
A3.27.8. **Satisfactory Fixes**. All fixes may be defined by use of the Airborne Radar system. The fix error used in the design of the procedure will be based on the type of airborne equipment to be used as follows:
A3.27.8.1. A fix error displacement of plus or minus 500 feet may be used and procedure annotated in the Planview: PROCEDURE NOT AUTHORIZED FOR APN-59 EQUIPPED AIRCRAFT.
A3.27.8.2. If a procedure must be designed to accommodate APN-59 equipped aircraft, a fix error displacement of plus or minus ½ mile must be used.

A3.28. AFJMAN 11-226, Chapter 12 (Departure Procedure Criteria):
A3.28.1. AFJMAN 11-226, paragraph 1202: Use tracks from the Departure End of Runway (DER) or radials or bearings from suitable navigational aids to define sector limits. Apply diverse departure criteria to all locations where the USAF is responsible for instrument procedure development, including those in NATO countries. On a chart or map, tabulate the obstacle(s) that penetrate the 50:l OIS according to AF Form 3636, *Application of Diverse Departure Criteria*. Provide this information to airfield managers and flying organizations for flight planning purposes. Forward diverse departure documentation and drawings to parent MAJCOM TERPS office. Establish departure procedures or SIDs to provide safety of flight during departure operations when obstacles penetrate the 40:l OIS.
A3.28.2. AFJMAN 11-226, paragraph 1202a[1]: Make sure the area is long enough for the Obstacle Identification Surface (OIS) to reach 304 feet above airport elevation.
A3.28.3. AFJMAN 11-226, paragraph 1202a[2]: The OIS begins at DER elevation.
A3.28.4. AFJMAN 11-226, paragraph 1203: When a Dead Reckoning (DR) segment extends more than 10 NM from the DER or beyond 5 NM after completing a turn, the area continues to splay to points abeam the point where Positive Course Guidance (PCG) is established.
A3.28.5. AFJMAN 11-226, paragraph 1203a(1)(a): When PCG is provided by a localizer, publish a note which reads, "CAUTION: Back course procedures apply."
A3.28.6. AFJMAN 11-226, paragraph 1203a[2]: The OIS begins at DER elevation.
A3.28.7. AFJMAN 11-226, paragraph 1203b: See A3.26.4, this attachment.
A3.28.8. AFJMAN 11-226, paragraph 1203b[2](a): The OIS begins at DER elevation.
A3.28.9. AFJMAN 11-226, paragraph 1203c:
A3.28.9.1. Use airport, vice DER, elevation in determining when a combination straight and turning departure must be developed.
A3.28.10. AFJMAN 11-226, paragraph 1203c[2][a]: The OIS begins at DER elevation.
A3.28.11. AFJMAN 11-226, paragraphs 1204 and 1207c: Procedures requiring an early turn are nonstandard.
A3.28.12. AFJMAN 11-226, paragraph 1205d: Close-in obstacles are defined as any obstacle within 1.5 NM of DER within Zone 1. If early turn criteria is required IAW AFJMAN 11-226, paragraph 1204, a close-in obstacle is considered to be any obstacle within 1.5 NM of the DER which penetrates the OIS in Zone 1 and Zone 2.
A3.28.13. AFJMAN 11-226, paragraph 1205e: Do not use the criterion in this paragraph.
A3.28.14. AFJMAN 11-226, paragraphs 1205f and 1207:
A3.28.14.1. Publish climb gradients as vertical velocity tables according to Interagency Air Cartographic Committee SID Chart US (IACC-7). Publish the altitude or fix to which the climb gradient must be maintained.
A3.28.14.2. The following obstacles are depicted when they penetrate a 50:l OIS:
A3.28.14.2.1. Highest and controlling obstacle(s) within the departure area.
A3.28.14.2.2. Obstacles located outside the departure area that dictate design of the procedures.
A3.28.14.2.3. When close-in obstacles dictate a climb gradient (CG), you may be able to eliminate it by specifying a minimum crossing height over the DER . Use this height in calculating the climb gradient. NOTE: When a runway end crossing height is established, the 40:1 OIS begins at that height. Depict the obstacles requiring such heights.
A3.28.14.2.4. Publish DR tracks, not headings, to be flown, for example, "Climb on a Track of XXX," not "Climb on Runway Heading."
A3.28.15. Develop SIDs to portray specific departure routes required by Air Traffic Control (ATC) and operational agencies, and when necessary, to avoid obstacles. SIDs are charted according to DoD Annex to IACC-7. Use the departure route criteria in paragraph 1203, as supplemented in this document. Use the guidance in FAA Order 7100.8, SID, as follows:
except do not use the terms "Vector" and "Pilot Nav."
A3.28.15.2. Military SIDs**.** Paragraph 9B applies.

A3.28.16. Publish Departure Routes in the front of Terminal FLIP products under the heading of "IFR Take-Off Minimums and Departure Procedures" when a penetration of the 40:1 OIS Diverse Departure evaluation exists. (***NOTE:*** This would not be required if a SID is published to compensate for a 40:1 OIS penetration.) Use the departure route criteria in paragraph 1203, as supplemented in this document. Departure Routes will be published using AF Form 3634 and will be done in text form only. A picture (i.e., Planview) will ***not*** be displayed. If the route requires a climb gradient in excess of 200 feet per nautical mile, a ceiling and visibility will also be published for civil users. ***NOTE:*** This is ***not*** considered the publication of a diverse departure.

A3.29. AFJMAN 11-226, appendix 5, paragraph 1. In addition to referenced paragraph, observe the sequenced flashers are not a part of the approach lighting system when applying credit for lights to instrument procedures. If the sequenced flashers are inoperative, the visibility minima for a procedure are not affected. However, if the Runway Alignment Indicator Lights (RAIL) are part of the approach lighting system (MALSR and SSALR), and the RAIL portion of the system becomes inoperative, revert to no-light visibility minimum.

Figure A3.1. Approach Light Surface.

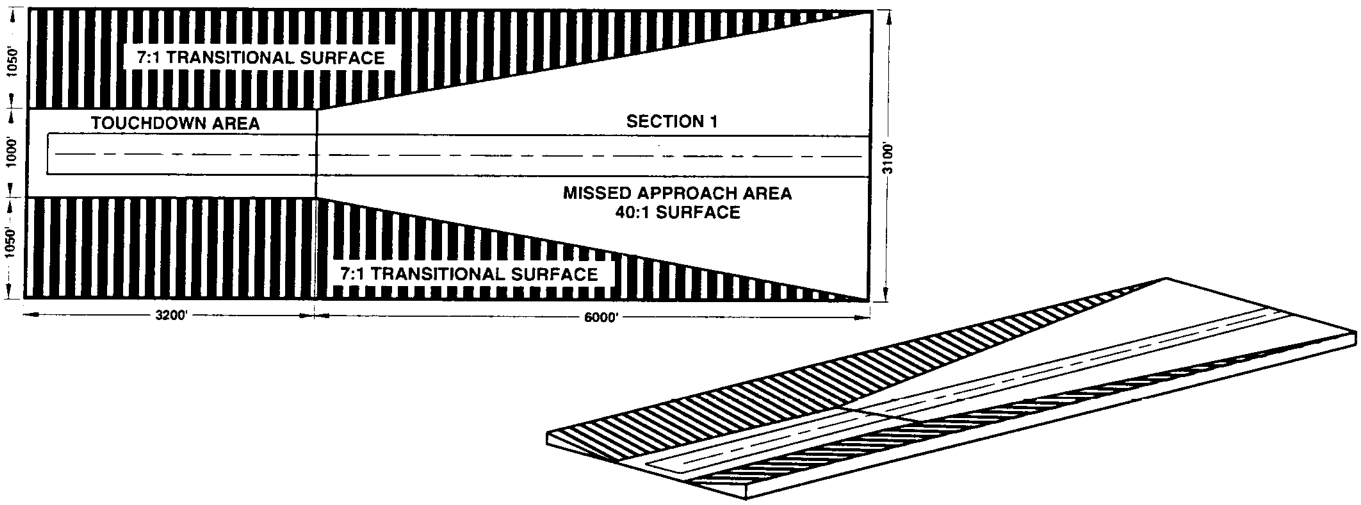


1. **THE APPROACH LIGHT AREA** is a 400-foot-wide rectangle with its longitudinal axis on the extended centerline of the runway. It extends outward from the end of the Touchdown Area nearest the runway threshold (see figure A 3.5) to a point 200 feet beyond the last approach light fixture.

2. **THE APPROACH LIGHT PLANE** is normally an imaginary horizontal plane which overlies the approach light area. It originates at the landing runway threshold, at that elevation, and passes through the beam centers of all steady burning lights in the system.

3. **THE APPROACH LIGHT SURFACE** is an inclined imaginary surface which normally has a 50:1 slope. This surface originates at the same point as the final approach obstacle clearance surface (see A3.22.4.1.1), at the elevation of the runway threshold, and overlies the approach light area. The 50:1 surface remains constant as long as ILS glide slope angles of 2.5 degrees or higher are used. When glide slope angles less that 2.5 degrees are established, the approach light surface will be coincidental with the final approach surface.

Figure A3.2. Obstruction Clearance Areas

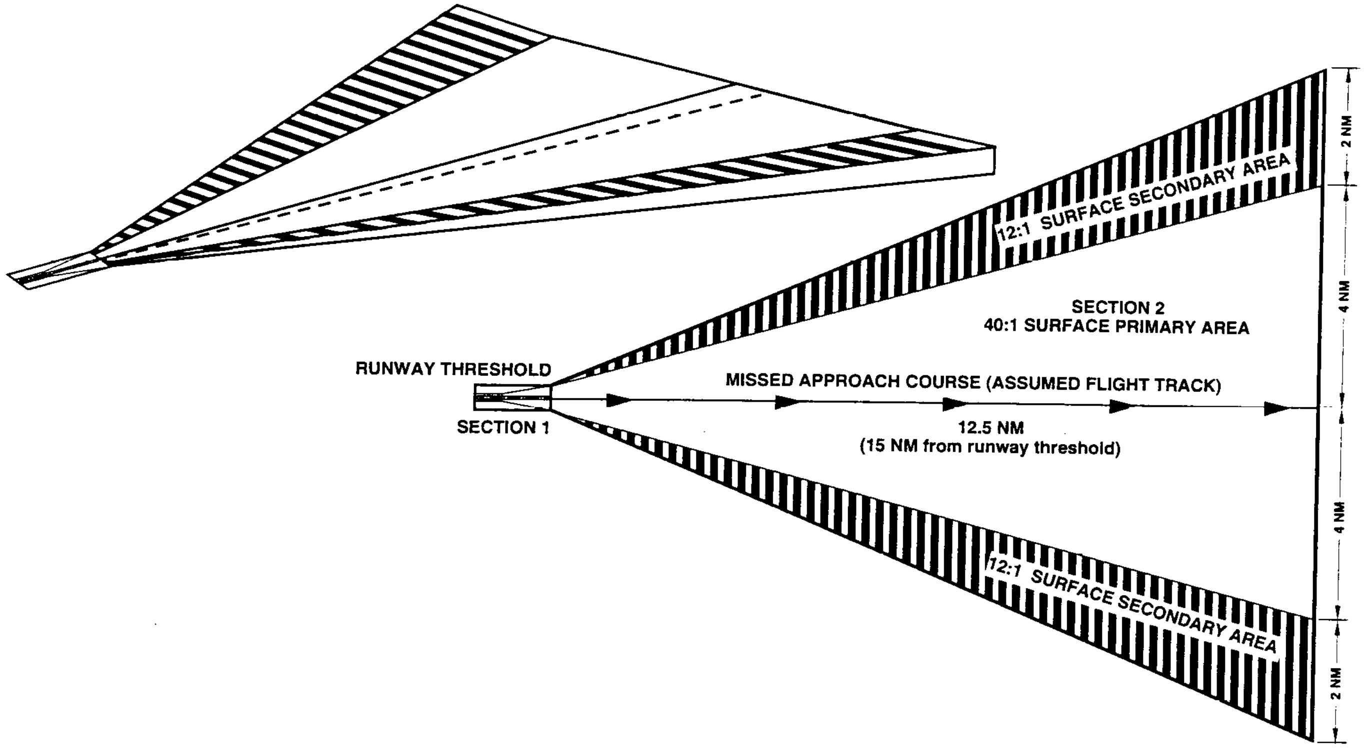


1. **THE TOUCHDOWN AREA** is a 3,200-foot-long by 1,000-foot-wide rectangle centered on the runway centerline. It begins 200 feet outward from the runway threshold (normal or displaced) and extends 3,200 feet in the direction of landing.

2. **THE MISSED APPROACH AREA,** SECTION 1, is a 6,000-foot-long trapezoid that is longitudinally centered on the runway centerline. It begins at the end of the touchdown area as shown. Its width is 1,000 feet at the beginning and expands uniformly to 3,100 feet at the opposite end. The surface inclines upward at a 40:1 ratio from the runway centerline elevation at the beginning of Section 1. At the end of this section, the surface is 150 feet.

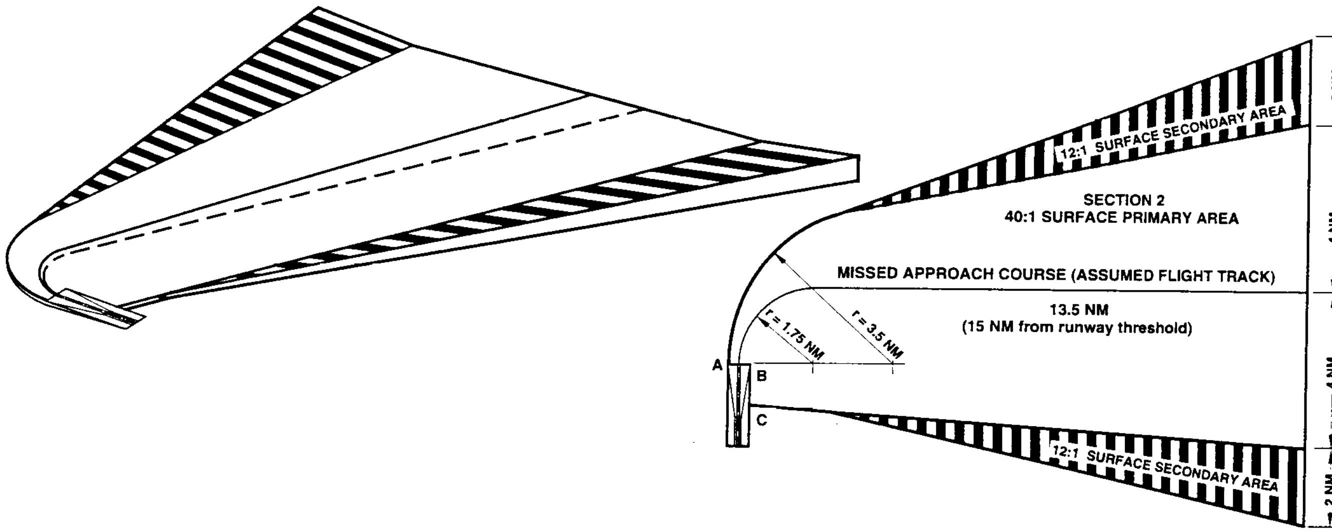
3. **THE TRANSITIONAL SURFACE** slope upward and outward from the edges of the touchdown area and Section 1 of the missed approach area at a ratio of 7:1. They extend upward to 150 feet above the height of the runway centerline.

Figure A3.3. Straight Missed Approach Area (Section 2).



THE MISSED APPROACH AREA, SECTION 2, starts at the end of Missed Approach, Section 1, and is centered on an extension of the Section 1 course. It is 3,100 feet wide at the beginning and expands uniformly to 8 miles wide at a point 15 NM from the runway threshold. When positive course guidance is not provided, secondary areas must be added as shown. The secondary area surface slope upward and outward at a ratio of 12:1 from the outer edges of the Missed Approach, Section 2 surface.

Figure A3.4. Turning Missed Approach Area (Section 2).



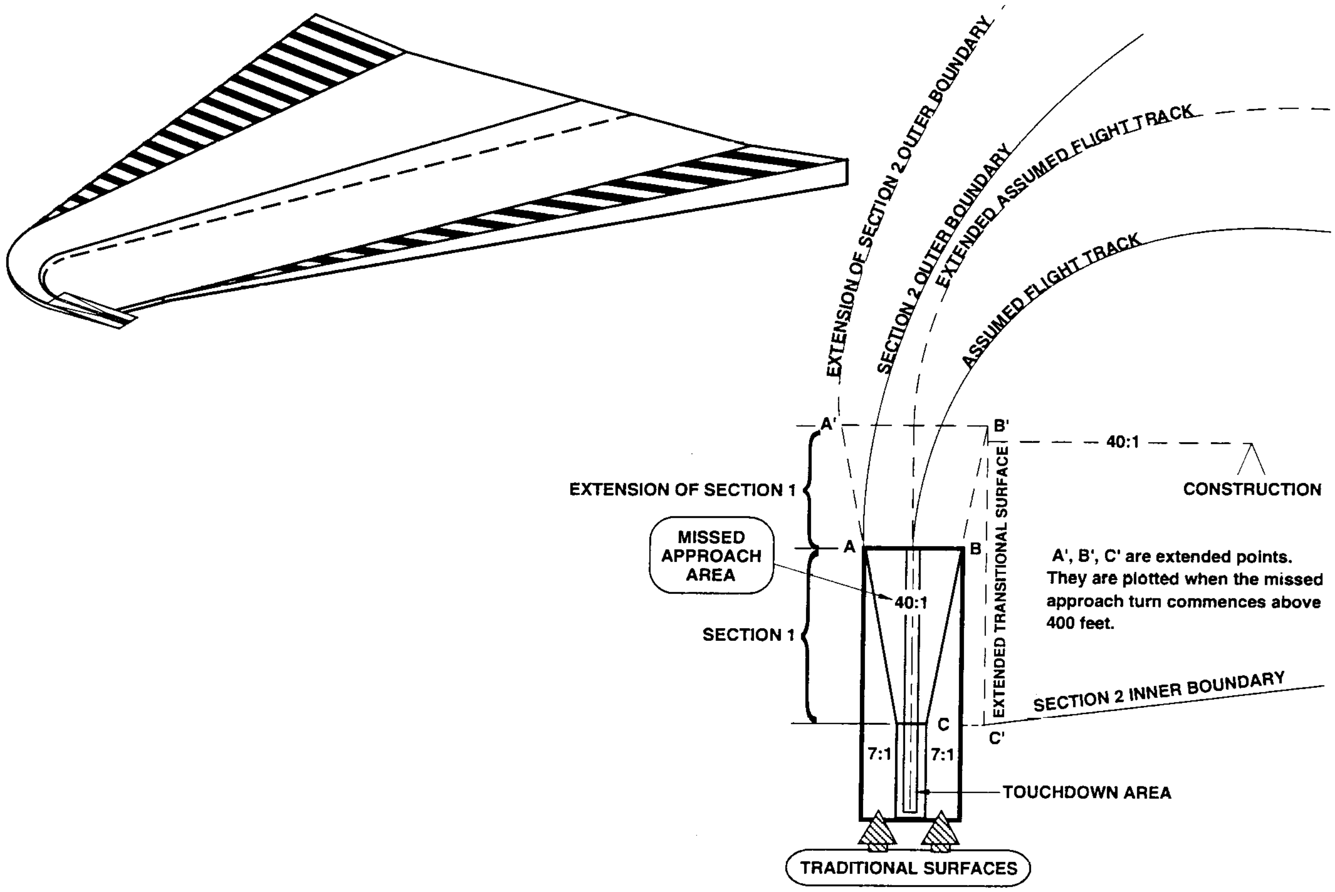
1. It is assumed that each aircraft executing a turning approach will climb straight ahead to an altitude of 400 feet (above the runway centerline elevation at the end of the touchdown area) at or prior to the distant end of Missed Approach, Section 1.

2. The assumed flight track turn radius is 1.75 NM (Category E-2.5 NM) and begins at the end of Missed Approach Area, Section 1. The outer boundary begins at point A and is 3.5 NM (Category E-5.0 NM) radius. The inner boundary commences at the edge of the transitional surface at point C which is adjacent to the end of the touchdown area that joins Section 1 of the Missed Approach Area.

3. Section 2 of the missed approach expands to 6 NM on each side of the flight track at 15 NM. When positive course guidance is provided secondary areas may by used. (See AFJMAN 11-226)

4. The missed approach surface in Section 2 is also inclined at the ratio of 40:1 beginning at 150 feet (the height of the surface at the end of Section 1). To determine the height of the missed approach surface over any obstruction in Section 2, measure the distance from the obstruction to the nearest point on line A-B or line B-C. Then compute the height of the surface using 40:1 ratio originating 150 feet above the runway. If the surface does not clear all obstructions or if the aircraft is required to climb more than 400 feet straight ahead, then Section 1 must be extended (see figure A 3.5).

Figure A3.5. Turning Missed Approach Area Construction Detail.



1. When necessary, Section 1 must be extended 4,000 feet longitudinally for each 100 feet that the missed approach aircraft is required to climb above 400 feet prior to initialing a turn. The 7:1 transitional surface on the inside of the turn must also be extended, as shown, and its outer edge height equals the height of the distant end of the extended Missed Approach, Section 1.

2. To determine the height of the missed approach surface over any obstruction in section 2, measure the distance from the obstruction to the nearest point on line A'-B' or line B'-C'. Then compute the height of the surface using the 40:1 ratio originating at the height of the end of the extended Missed Approach, Section 1.

PROCEDURE PACKAGE REQUIREMENTS

Forward To	Standard Procedure	Non-Standard Procedure	Host Nation Standard	Host Nation Non-Standard
MAJCOM TERPS or CCGP	AF Form 3632, 3634, or 3637 -Computation Sheets* -Maps, Charts, Drawings or Overlays -Procedure Build -ESV (If Applicable) -FAA Form 8260-2 (If Applicable) See Note 1	-AF Form 3632, 3634, or 3637 -Computation Sheets* -Maps, charts, Drawings or Overlays -Procedure Build -ESV (If Applicable) -FAA Form 8260-2 (If Applicable) -Supporting Documents -AF Form 3980 (Waiver Form)	(Prepares Package) See Note 2	(Prepares Package) See Note 2
MAJCOM/DO	N/A	-AF Form 3632, 3634, or 3637* -AF Form 3980 (Waiver Form)	-N/A	-AF Form 3632, 3634, or 3637* -Supporting Documents -Host Nation Procedure -AF Form 3980 (Waiver Form)
AFFSA/XOIP	N/A	-All items listed above that are required for MAJCOM TERPS or CCGp -AF Form 3992 or 3993 (Flyability Check)	-N/A	-Same as above -AF Form 3992 or 3993 (Flyability Check)
NIMA	-AF Form 3634, or 3637*	-AF Form 3634 or 3637*	-AF Form 3634 or 3637*	-AF Form 3634 or 3637

* Computer printouts replace manual computation forms for automated products.
** Submit only if requested.

NOTES:

1. For flight inspection, forward to the FIO:

- AF Form 3637*.
- Copy of map with all segments of the procedure portrayed.

2. Coordinate with Host Nation authorities when publishing new procedures (host nation procedures not available) or publishing procedural changes which differ from published host procedures. Forward:

- AF Form 3632, 3634, or 3637*.
- Host nation procedure.
- Supporting Documents.
- AF Form 3980 (Waiver Form for Non-standard procedures only).

INSTRUCTIONS FOR COMPLETING TERPS FORMS

NOTE: The following paragraphs provide guidance on preparing common TERPS forms.

A5.1. AF Form 3628, TERPS Automation Data Summary: This form contains the baseline data (airfield and NAVAID information) for TERPS automation.

ACCURACY
Use the most accurate data available. Data required on other forms must agree with data on AF Form 3628. Minimum standards shall not be less than those listed below:
A5.1.1. Distance:
A5.1.1.1. The nearest foot when formulating distance and elevation measurements in feet.
A5.1.1.2. The nearest tenth of a mile for distances reported in statute/nautical miles.
A5.1.2. The nearest hundredth of an arc second when reporting geographical coordinates.
A5.1.3. The nearest degree when reporting true/magnetic values (radials, bearings, courses, etc.). True runway azimuth shall be reported to the nearest hundredth of a degree.
A5.1.4. All elevations are mean sea level (MSL).

FORM CONTENT (Blocks).
1. General:

a. Airport.
b. Location. Enter name of associated city and state (host nation, if applicable).
c. Operating Agency (USAF, FAA, Host Nation, etc.).
d. Owner. Actual owner (FAA, USAF, foreign country, etc.).
e. ICAO Identifier.
f. Airport Elevation. The highest point on the usable runway(s) measured in feet MSL.
g. Magnetic Variation. Enter the assigned Epoch magnetic variation and year for the area (8.00 E 1995). If the station is north of 67 degrees north, give the magnetic grid variation to the nearest degree.
h. Airport Reference Point. Latitude and Longitude for the airport reference point. Center of landing surface according to AFR 86-14.
i. Airport Horizontal Datum. Geodetic datum used to determine the ARP (EX: NAD 83/WGS 84 in CONUS). See attachment 10 for datum codes.

2. Airfield Information:

a. Runway Number.
b. Length of Landing Surface.
c. Width of Landing Surface.
d. Threshold Elevation.
e. Touchdown Zone Elevation.
f. Runway Departure End Elevation.
g. Displaced Threshold. Enter runway and exact distance displaced.
h. Runway Slope in Percent.
i. Runway True Azimuth. Enter to two decimal points (Example*:* 312.71).
j. Runway Coordinates. Coordinates for the physical end of the runway. For runways with displaced thresholds, enter the coordinates of the displaced threshold. Also, enter the departure end coordinates for each runway.

3. Approach Lighting or Equivalent. Enter runway number, IACC code, and the length of approach lights. Check appropriate lighting system blocks. Indicate availability of other systems by placing a check in the appropriate blocks. Use remarks section (Item 9) for any necessary explanations.

4. Remote Altimeter Setting Source (RASS):

a. Enter LAT/LONG of altimeter source according to AFJMAN 11-226.
b. Check appropriate box if adverse assumption was applied according to AFJMAN 11-226.

5. Communications Data. Include the identification and UHF/VHF radio frequencies of the approach control, control tower, ground control, clearance delivery, and ATIS/UNICOM. Indicate PAR and ASR status by circling the appropriate response.

6. ILS/PAR/VGSI Information:

a. Runway Number.

b. Runway Elevation at Runway Point of Intercept (RPI). Enter the crown elevation of the runway abeam the ILS glideslope antenna and PAR RPI elevation for existing procedures.

c. Distance Touchdown Reflector to Threshold and PAR Antenna to Touchdown (TD) Reflector. The antenna to reflector distance, when the Course Line Amplitude (CLA) reflector is not collocated, is slant range (that is, actual straight line distance from antenna to reflector). When using GPN-22 or TPN-19 precision radars: compute an equivalent location of the TD reflector for AN/GPN-22 and AN/TPN-19 precision radars by using the following formula. Enter computed data "C" and "E" from the formula in item 6c blocks as with other PAR systems. Include the parameter panel (distance to touchdown) setting in the remarks section (item 9).

$C = \sqrt{A^2 + (D - B)^2}$ $E = D - C$

A - PAR antenna to centerline. (This is obtained from parameter panel setting value "distance to runway.")
B - RPI distance. (This is obtained from parameter panel setting "distance to touchdown (TD).")
C - PAR antenna distance to TD reflector.
D - PAR antenna distance to threshold.
E - TD reflector distance to threshold.

d. **Glideslope Intercept Altitude.** Enter Glideslope (GS) intercept altitude for PAR and ILS. If PAR and ILS GS intercept altitudes are different, split the block and enter PAR intercept altitude on top.

e. **Glideslope Angle.** Enter in degrees and hundredths.

f. Visual Glideslope Indicator (VGSI). Enter according to form.

7. Computations. Indicate whether smooth, or rapidly dropping terrain formula is used. Rapidly dropping terrain formula (AFJMAN 11-226, figure 129) should be used at all USAF facilities. If more than one ILS is available and terrain is different for each ILS, indicate the difference in the remarks section.

8. NAVAID Information:

a. **Facility.** List any facility used for procedure design at your location. List in the remarks section which facilities are restricted, but DO NOT list the restrictions.

NOTE: When a PAR serves more than one runway, enter the position (coordinates X and Y distances) of the facility in relation to the different runway thresholds it serves.

b. **Facility Identification.** 2 or 3 letter identifier.

c. **ILS Glideslope Antenna Base Elevation.** MSL elevation for each antenna base.

d. **ILS Glideslope Antenna to Threshold Distance.** Distance to the nearest foot.

e. **Magnetic Slaved Variation.** Current assigned variation of the VOR, TACAN, and or VORTAC. Coordinate with MAJCOM to obtain current variation from the FAA Master Data Summary Listing. Enter magnetic orientation value of the ASR obtained from flight inspection of ATCALS evaluation reports.

f. **Cartesian Coordinates From Threshold.** Measure Cartesian coordinates from the runway the NAVAID serves. If NAVAID serves more than one runway, indicate from which threshold the measurement was taken. Attachment 6, this manual, describes how to measure Cartesian coordinates.

g. **Geographical Coordinates of Facility.** Latitude and Longitude of each facility. For Datum code numbers.

h. **Horizontal Datum.** Enter the NAVAID datum if other than the airport datum. See attachment 10.

9. Remarks. Use this section to help clarify any information above. If necessary, continue on bond paper.

10. Coordination Data. The date is important. It shows the most current form on file. The CATCO must sign each form to indicate review and concurrence.

A5.2. AF Form 3629, Obstruction Data. This form contains information on all obstacles within a given radius of an airport. This obstacle listing is used by TERPS automation for evaluating instrument procedures. There are two methods used to obtain this obstacle data. There is the “manual” method and AFTERPS DTED/DVOF obstacle search method. When using the AFTERPS DTED/DVOF method, you must continue to manually search CE MAPS for airfield obstructions that may or may not be included in the DVOF data (See paragraph 5.2.2.2).

A5.2.1. AF Form 3629 Data. ***NOTE:*** When using the AFTERPS DTED/DVOF obstacle search method, the AFTERPS Computer Generated (CG) AF Form 3629 will replace any previous manually developed AF Form 3629 used in the development of Master Obstruction Maps. Provide the following information in appropriate blocks:

A5.2.1.1. **General:**

A5.2.1.1.1. The area to be considered for obstacle search shall be a radius of 105 NM (or the boundary of airspace, whichever is greater) from the airport reference point (ARP). The ARP is considered to be the geographical center of the runway(s) for obstacle identification areas (OIA).
A5.2.1.1.2. Enter the date on top of each AF Form 3629/computer printout.
A5.2.1.1.3. If obstacles are added, deleted, or changed on the form/computer printout, change the date to reflect the current revision. Rationale must be provided for deletions/changes to obstacles.
A5.2.1.1.4. Number the pages of the form/computer printout in sequence. List each obstacle only once.
A5.2.1.1.5. Maintain a set of master maps which identify all obstacles listed on AF Form 3629/computer printout (See paragraph 4.2.2).
A5.2.1.2. **Obstacle Number.** Number all obstacles in sequence starting with number one (#1). Under no circumstances shall an obstacle number be used again once it has been deleted. Also, provide the date the obstacle was added or deleted.
A5.2.1.3. **Coordinates.** DO NOT list both geographic and Cartesian coordinates for obstacles. Obstacles are entered in the database with one or the other, not both. The automated database printout will provide both coordinates based on the appropriate coordinate entered. List coordinates as follows:
A5.2.1.3.1. **Geographic Coordinates (Latitude and Longitude).** Use geographic coordinates only if provided from an accurate source. Coordinates from surveys, National Imagery and Mapping Agency (NIMA), or National Ocean Service (NOS) documents are considered accurate sources. Report to the nearest tenth of a second.
A5.2.1.3.2. **Cartesian Coordinates (X and Y).** Use Cartesian coordinates unless geographic coordinates are provided for certain obstacles. The "X" axis shall be centered on the axis at the threshold of the primary instrument runway (see attachment 6). Enter runway number when Cartesian coordinates are used.
A5.2.1.3.3. **Elevation.** The elevation block will be the obstacle's MSL value. The AGL value may be added to the description/source block. When a chart depicts vegetation (coded by green coloring) in an area, it will be assumed, unless survey or other documentation exists, that the largest known type tree for the area of full grown height exists at the closest position toward the runway edge. Consult local utility companies for actual heights of utility poles. Adverse assumption may be used to consider the most critical height of unmeasurable obstacles (trees, power poles/lines, etc.). When assumptions are made, document source(s) used to apply assumed values in a cover letter attached to the AF Form 3629/computer printout. When evaluating contour lines, use the following technique to take care of the hilltops and draws: Use one foot less than the next appropriate terrain line (map contour interval is 20 feet. The highest contour line identified within a section is 300 feet. The elevation value reported on AF Form 3629 would be 319 feet).
A5.2.1.3.4. **Date.** Date obstacle added or deleted.
A5.2.1.3.5. **Description/Source.** Obstacle description (control tower, tower, contour line + trees, spot elev., etc.). Include the source of obstacle information (Altus Map 1:24,000, 1:250,000 JOG Air (series and sheet #), DVOF, CE MAP, etc.). Provide the geodetic datum of obstacle source if it is different from airport datum of Form 3628.
A5.2.1.3.6. **Horizontal Datum.** Geodetic datum of obstacle source. Enter only if different from Airport datum of AF Form 3628. See attachment 10 for datum code numbers.
A5.2.2. **Obstacle Search Procedures:**
A5.2.2.1. **General.** List all obstacles that are currently indicated as controlling obstacles for each segment of existing instrument procedures. Include holding areas; minimum vectoring altitude data; departure routes/SIDs; minimum sector areas; initial, intermediate, final, and missed approach segments; etc. The OIA consists of four independent areas of evaluation: the ARP-10 NM, 10-30 NM, 30-60 NM and 60-105 NM. Listed below are the minimum guidelines for accomplishing obstacle searches in these areas. Certain areas may require more stringent evaluations to achieve the best operational evaluation of the terminal area. When a different type of evaluation is done, fully document the method(s) used. Overlays may be designed to aid in construction of the obstacle identification areas. Perform construction, searches, and compilation as follows:
A5.2.2.2. **Obstacles Within 10 NM of ARP:**
A5.2.2.2.1. **Construction.** Topographic charts (1:24,000, 1:25,000, 1:50,000, or 1:62,500) and Civil Engineering (CE) maps will be used for the obstacle search in this area. On the appropriate topographic chart and CE map, construct the following areas to aid in identifying obstacles (figure A5.1):
A5.2.2.2.1.1. Draw 5-degree splay areas 360 degrees around the ARP from the runway edge outward to 10 NM from the ARP. The apex for the 5-degree splay areas will originate at the ARP.
A5.2.2.2.1.2. Define the mileage limits as follows: starting from the ARP, draw 360-degree arc radii at every .25 NM interval outward to 10 NM from ARP.
A5.2.2.2.1.3. The 5-degree splay area by .25 NM represents the area for obstacle identification. The area beginning at the ARP shall include the entire coverage of the appropriate CE map (C-1 or equivalent chart). ***NOTE:*** There may be installations that have adjacent or near-by military property which may have separate CE Maps that must be evaluated also.
A5.2.2.2.2. **Search Identification Procedures.** From the ARP outward to 10 NM, identify the obstacle/terrain with the highest elevation within **<u>each</u>** 5-degree splay by .25 NM section. The lowest threshold elevation will be used as the origin elevation.

A5.2.2.2.3. **Compilation.** Identify obstacle's height and measurement for inclusion on AF Form 3629. Obstacle measurements will be made from the threshold of the primary instrument runway once the highest obstacles are identified.

A5.2.2.3. **10 NM to 30 NM Area:**

A5.2.2.3.1. **Construction.** The Terminal Area Chart or equivalent chart, scale 1:250,000, will be used for the obstacle search in this area. The following area will be constructed to aid in identifying obstacles (figure A5.2):

A5.2.2.3.1.1. Draw 5-degree splay areas 360 degrees around the ARP, beginning at 10 NM outward to 30 NM. The apex for the 5-degree splay will originate at the ARP.

A5.2.2.3.1.2. Define the mileage limits as follows: Draw 360-degree arc radii for 10, 15, 20, 25, and 30 NM from the ARP.

A5.2.2.3.2. **Search.** Identify the highest obstacle/terrain elevation within **each** 5-degree splay by a 5 NM area which is greater than 400 feet above the lowest threshold elevation.

A5.2.2.3.3. **Compilation.** Same as in paragraph A5.2.2.2.3.

A5.2.2.4. **30 NM to 60 NM area or the boundary of airspace, whichever is greater:**

A5.2.2.4.1. **Construction.** The Sectional Aeronautical Chart or equivalent chart, scale 1:500,000, should be used for the obstacle search in this area. The following area will be constructed to aid in identifying obstacles (figure A5.3).

A5.2.2.4.1.1. Draw 10-degree splay areas 360 degrees around the ARP, beginning at 30 NM outward to 60 NM or boundary of airspace. The apex for the 10-degree splay will originate at the ARP.

A5.2.2.4.1.2. Define the mileage limits as follows: draw 360-degree arc radii of 30, 40, 50, and 60 NM from the ARP.

A5.2.2.4.2. **Search.** Identify the highest obstacle/terrain elevation within each 10-degree splay by a 10 NM area which is greater that 400 feet above the lowest threshold elevation. The elevation in the succeeding section must be equal to, or greater than the preceding section, e.g., if an obstacle in the succeeding section is lower than the obstacle in the preceding section, it does not have to be entered into the data base (manual method). ***NOTE:*** When using the AFTERPS DTED/DVOF obstacle search method, the highest obstacle will be identified in each section, regardless of what is in an adjacent section.

A5.2.2.4.3. **Compilation.** Same as in paragraph A5.2.2.2.3.

A5.2.2.5. **60 NM to 105 NM area:**

A5.2.2.5.1. **Construction.** 1:500,000 or 1:1,000,000 scale chart may be used. The following area will be constructed to aid in identifying obstacles (figure A5.4).

A5.2.2.5.1.1. Draw 20-degree splay areas 360 degrees around the apex of the ARP, beginning at 60 NM outward to 105 NM.

A5.2.2.5.1.2. Mileage areas are arc radii at 75 NM, 90 NM, 105 NM.

A5.2.2.5.2. **Search.** Identify the highest obstacle/terrain elevation within each 10-degree splay by a 15 NM area which is greater than 1000 feet above the lowest threshold elevation. The elevation in the succeeding section must be equal to, or greater than the preceding section, e.g., if an obstacle in the succeeding section is lower than the obstacle in the preceding section, it does not have to be entered into the data base (manual method). NOTE: When using the AFTERPS DTED/DVOF obstacle search method, the highest obstacle will be identified in each section, regardless of what is in an adjacent section.

A5.2.2.5.3. **Compilation.** Enter lat/long coordinates and datum (if different than the ARP datum) into the AF Form 3629.

A5.3. AF Form 3630, TERPS Automation Request. This form is used by units to request MAJCOM TERPS support for automating instrument procedures.

A5.3.1. Indicate whether the request is routine or priority. The following is general guidance.

A5.3.1.1. Routine requests for new or revised procedures will normally be completed within 45 days of request.

A5.3.1.2. Routine requests for validating existing procedures will normally be completed within 60 days of request.

A5.3.1.3. Priority requests will be completed ASAP and should normally be for those procedures which require NOTAM action or where safety of flight is a factor. Priorities for short-notice exercises, contingency operations, etc., will be approved on an individual basis. CATCOs should carefully scrutinize priority requests and indicate their approval.

A5.3.2. Indicate the type of request. Validation of procedures which have previous TERPS automation packages should first be scrutinized by the unit TERPS specialist. If new obstacles are identified, the TERPS specialist should use existing overlays to see if the new obstacles affect the procedure, only then should a request for validation be submitted. Only those segments which are affected will be validated.

A5.3.3. Complete all known information on AF Form 3630 for each of the segments of all instrument approach procedures (IAP). Holding airspeed and highest holding altitude blocks shall be completed for every procedure request requiring development of a holding pattern(s).

A5.3.4. Indicate the scale of maps you will be using to verify the automated TERPS procedure. The computer draws the procedure on a 6 1/2 by 6 1/2 inch sheet of paper/acetate. Large segments require several drawings of different areas to cover the whole segment. Use discretion and good TERPS judgment when requesting drawings for large scale maps. See attached chart scales and equivalents (Figure A5.5.).

A5.3.5. The plan view or FLIP product will help most in completing the requested procedure. Make sure the plan view can be easily understood. If the plan view does not clearly define the exact location of the intermediate fix, include the information on the front of the form. This is particularly important for dead reckoning segments that will be connected to the intermediate segment.

A5.3.6. Include any additional information in the remarks section. Include the date of the current AF Forms 3628 and 3629 and list all revision numbers and dates to ensure the most current database has been entered into the computer.

A5.4. AF Form 3632, Minimum Vectoring Altitude Chart (MVAC). This form is used to show the plan view layout of the minimum vectoring altitudes within a given area around the Airport Surveillance Radar (ASR) antenna and coordination signatures.

Item 1. **Name of Facility and Type of Equipment.** Enter name of facility providing radar air traffic services and type of ASR equipment (for example Minot RAPCON, GPN-12).

Item 2. **Name of Airport.**

Item 3. **Effective Date.** Enter date based on current/proposed allocated airspace used for radar vectoring. Enter actual date after MAJCOM approval.

Item 4. **Location.**

Item 5. **MVAC Depiction.** Depict MVA information as required in this manual. Azimuths are magnetic. Distances are in nautical miles (NM) measured from the radar antenna. Depiction may be altered for clarity or best-use depiction purposes (for example, label sector line(s) adjacent to defined point versus on the outside ring of MVAC). DO NOT depict exceptions to MVA (FAAH 7110.65) on MVAC.

Item 6. **Coordination.** Obtain all signatures. Signatures of all agencies will represent their coordination and approval of MVAC.

Item 7. **ASR Slave Assigned Variation.** Enter magnetic orientation value of ASR obtained from flight inspection or ATCALS evaluation reports.

Item 8. **Obstacle Data.** Identify obstacle to include:

a. **Sectors.** Enter sector numbers, to agree with those from AF Form 3633, on AF Form 3632 drawing and in these blocks (360 - 090 degrees, 0 -15 NM).

b. **Controlling Obstacle.** Describe obstacle (terrain + trees, tower, etc.) and include its AF Form 3629 number.

c. **Elevation and Coordinates.** Enter MSL elevation of obstacle to the nearest foot. Enter location of obstacle by latitude and longitude to the nearest second. Extract this data from AF Form 3629 or indicate source of information above coordinates (JOG NM 14-2).

Item 9. Remarks. This section is used to expand or explain any item(s) on AF Form 3632 or 3633. Explanations/Calculations should be concise and identify specific affected items on these forms or a specific paragraph reference in a regulation pertaining to data herein. An isolated prominent obstacle may be eliminated as the controlling obstacle in a sector according to this manual, figure 3.1, paragraph c. Document calculations in the remarks section in the same format as sector calculations on AF Form 3633 when an isolation buffer is used.

A5.5. AF Form 3633, Minimum Vectoring Altitude Computations. This form is used to show minimum sector altitudes and the obstacles which control them for both the MVAC and the MIFRAC. NOTE: When this form is being used to develop the MIFRAC, references to the MVAC will be crossed out and replaced with MIFRAC.

Section A--MVA Required for Terrain/Obstacle Clearance

1. **Description of controlling obstacles.** All established sectors shall be evaluated. Evaluate each sector and a 3 or 5 NM buffer completely around the sector as depicted in AFJMAN 11-226, figure 2 (MSA). A master drawing of sector and buffer areas shall depict controlling obstacles used for AF Form 3633 computations. Obstacles should be identified by AF Form 3629 number, if available. Controlling obstacles for both basic and buffer sector areas shall be identified.
2. **Controlling Obstacle Height.** Self-explanatory.
3. **Required Obstacle Clearance (ROC).** Check FLIP APs (1, 2, 3, or 4) to ascertain if your operating location is a designated mountainous area. Within designated mountainous areas, obstacle clearance may be reduced to not less than 1000 feet when necessary to achieve altitude interface with other procedures and when precipitous terrain is not a factor. This minimum altitude must be at least 300 feet above the floor of uncontrolled airspace. When these reductions are used to achieve an operational advantage, document thoroughly on reverse side of AF Form 3632. If precipitous terrain is determined to be a factor in the sector(s), either by local operational or flight inspection personnel, apply recommended adjustments according to AFJMAN 11-226, paragraph 1041b(3). Documentation of precipitous terrain adjustment determination shall be provided with AF Form 3633. A caution note should be included in the IFR supplement when precipitous terrain determinations are made. (Example***:*** Area between LTS 330-R to 350-R from 9 DME to 15 DME designated as precipitous terrain).
4. Required Altitude Based on Obstacle Clearance. Self-explanatory.

Section B--MVA Required for Airspace

1. **Floor of Controlled Airspace (AGL).** FAAH 7400.2, *Terminal Airspace Section*, contains data on the floor of designated controlled airspace. The floor of controlled airspace is: Ground level within Class B, C and D Airspace; 700 ' AGL, 1200 ' AGL or 14,500 ' MSL for Class E Airspace. ***NOTE:*** Airports that have instrument procedures and no control tower, **may** have Class E Airspace beginning at the surface. The highest floor of controlled airspace within the sector shall be used. Location of the highest terrain within the sector is not the determining factor when selecting the floor of controlled airspace, e.g., the highest terrain lies where the floor of controlled airspace is 1200 ' AGL, however, the highest floor of controlled airspace within the sector may be 14,500 ' MSL. Host nations normally designate the floor of controlled airspace in their AIPs. However, host nations compute this data differently than US criteria. Check with appropriate host nation personnel to ensure accurate information is applied. If a host nation AIP does not designate the floor of controlled airspace, controlled airspace shall be considered to begin at the surface.
2. **Surface.** Ascertain the highest terrain within the sector to obtain the surface. (***NOTE:*** This is a bald terrain evaluation, without any man-made or vegetation obstruction additions.) Example: In a given sector, a spot elevation is found to be the highest elevation. This would be the figure used as that sector's surface.
3. **Floor of Controlled Airspace (MSL).** Sum of 1 and 2 above.
4. **Standard ROC.** 300 feet.
5. **Required Altitude Based on Airspace Floor.** Self-explanatory.

Section C--Selected Sector Altitude

1. Selected sector altitude must be the highest of section A or B.
2. Section A has two areas (basic sector and buffer). The controlling sector altitude must be a least 300 feet above the floor of controlled airspace.

A5.6. AF FORM 3634, Departure Route/Standard Instrument Departure. This form is used to coordinate agency approval and publish SIDs/depict departure routes.

Item 1. **Departure Name.** Enter the departure name and number as you want it to appear on published data. Name departures according to FAAO 7100.8.

Item 2. **Airport Name**.

Item 3. **Departure Computer Code.** This is according to FAAO 7100.8. Coordinate with servicing FAA ARTCC on assignment and effective date of departure computer codes.

Item 4. **Location.**

Item 5. A. **Type of Departure**.

B. **How To Publish.** Indicate which product is required. If NIMA loose-leaf, attach distribution list and/or state if negative is required.

Item 6. **Effective Date.** Enter requested date based on operational requirements and integration into ARTCC computer system. The actual effective date is entered by final review authority after coordination with all concerned agencies. Indicate if procedure is original or amended. If amended, type amendment number on right side of block.

Item 7. **Plan View:**

a. Depict the airfield and prepare a graphic illustration of the complete departure routing. The chart shall encompass the area required to effectively show the departure routing, including transitions to the appropriate en route structure.

b. One procedure shall be shown on the form. Takeoff portrayals from more than one runway, or opposite ends of a runway, are not to be treated as separate procedures.

c. All routes, turns, altitudes, radio aids to navigation, facilities forming intersections and fixes, and those facilities terminating the departure route (where the procedure joins the altitude structure for which the departure was established), shall be shown in graphic illustration. For each transition, include the name of the chart (L-1 or H-5) that shows the enroute facility. Show the mileage and courses, radials, or bearings between runway(s) and facilities or fixes along the route of flight.

d. Normally, the depiction is centered either on the airport runways or primary NAVAID. Depiction's may be offset in order to better utilize the plan view area to enhance readability. All drawings shall be oriented to true north.

e. In addition to the above data, include:

(1) **Communications.** Generally, the communication shown shall be one primary VHF and UHF frequency for:

(a) Automatic Terminal Information Service (ATIS).
(b) Clearance Delivery (CLNC DEL).
(c) Ground Control (GND CON).
(d) Tower (TWR).
(e) Departure Control (DEP CON).
(f) Center.
(g) Other agencies as required.

(2) **Special Use Airspace (SUA).** SUA shall be shown only when considered critical to the procedures as designated by requesting agency.

(3) **Obstacles:**

(a) Controlling segment and other prominent obstacles which would create a hazard to safe navigation in the event departure procedures were not executed precisely shall be shown in their exact geographic location so as to be in true relationship to the departure procedure. When portrayal of several obstacles in a small area would tend to create clutter, only the highest of the group need be shown.

(b) The elevation of the top of the obstacle(s) above mean sea level shall be shown to the nearest foot.

(4) **Minimum Climb Rate:**

(a) When established, a minimum rate of climb table, as determined by the controlling obstacles or ATC, shall be placed in the blocks in the upper right-hand corner. Climb gradients required for ATC purposes shall be displayed when they are higher than the minimum climb rate. NOTE: Climb gradients required for obstacle avoidance or ATC purposes do not require a waiver.

(b) Minimum and ATC climb rates shall be shown as vertical velocities (V/V) in feet per minute (fpm) in 60 knot increments, from 60 knots to 240 knots for low altitude and 120 knots to 360 knots for high altitude departures. The V/V equals the climb gradient times ground speed divided by 60.

(c) Where multiple runway departures are required, provisions shall be made in the minimum climb rate table to show the V/V information for all runways involved. For additional runways, draw more blocks to extend the columns vertically down the page.

(d) An asterisk(s) will be used to footnote which climb gradients are ATC required.

(e) When the climb rate is premised on an ATC requirement, the following note will be shown immediately below the V/V box: "ATC Climb Rate." Minimum or ATC climb rates must indicate the altitude and/or fix at which the climb gradient is no longer required.

(5) ***NOTES*:**

(a) Operational notes shall be held to an absolute minimum and shall be based on mandatory user requirements.

(b) Procedural data notes shall be entered to be consistent with a safe execution of the procedure.

Item 8. **Departure Route/SID Description.** A written description of the departure procedure, including all turns, altitudes, headings, distances, facilities/fixes, and all routes (indicating number if on airways, or direct, if off airways) to the terminating facility/fix. Add the computer code for transitions, where applicable. ***NOTE:*** When revising Item 7 or 8 of previously published departures, attach a copy of the previous version with revisions clearly indicated.

Item 9. **Controlling Obstacles:**

Takeoff Obstacles. Identify obstacles located in Zone 1/Section 1 which require nonstandard takeoff minimums and/or a climb gradient to be published. List the runway affected, MSL elevation, type obstacle (i.e. terrain/tower), and coordinates to the nearest second.

Departure Obstacles. Identify obstacles outside Zone 1/Section 1 but within subsequent departure trapezoids which require nonstandard takeoff minimums and/or climb gradient to be published. In some cases where specific departure routing is required, the controlling obstacle may be outside the trapezoids.

Item 10. **Adjustment for Close-In Obstacles.** For adjustment, enter the minimum height (AGL), in feet, for the aircraft to be over the departure end of runway (DER). If an adjustment is required, enter the number of feet in Item 10 and also as a note in the plan view. Examples of notes are: "Cross DER at least 20 feet AGL/187 MSL," or "Cross DER at least 5 feet AGL/3685 MSL due to barrier equipment."

Item 11. **Civil Takeoff Minimum.** List the takeoff minima for the benefit of applicable civil users.

Item 12. **Expanded Service Volumes (ESV).** If a facility/fix is used beyond the distance for normal usage of NAVAIDs, an ESV check is required. Complete FAA Form 6050-4 and maintain approved copies with departure procedure(s).

Item 13. **Airspace Requirements.** To afford separation from other aircraft, all departure procedures shall be contained in controlled airspace to the maximum extent possible within the capabilities of the ATC system. Consult AFI 13-201, FAAO 7400.2, FAAO 7400.8, and FAAO 7400.9.

Item 14. **Waiver Requirements.** List any waivers required for new or amended procedures. List the number of approved waivers on file for amended procedures and the approval date for each waiver. These waiver listings can be placed in Item 15 (Remarks) or continued on bond paper as needed. Waiver requests and approvals should support each affected procedure. Send completed package to HQ AFFSA/XOIP for approval.

Item 15. **Remarks.** Enter other pertinent data necessary to publish an accurate departure.

Item 16. **Departure ID.** Self-explanatory.

Item 17. **Coordination.** All signature blocks should be signed. MAJCOM and HQ AFFSA/XOIP signatures are only required for waivers to IAP's.

A5.7. AF Form 3635, Application of Departure Route Criteria. This form is used to document obstacle clearance along departure routes. This applies to departure routes which are published as Standard Instrument Departures (SID) or any other type of departure route used under instrument flight rules. A separate form is required for each runway used in the published departure.

Item 1. **Airport Name**.

Item 2. **Location**.

Item 3. **Runway Number and Departure End of Runway (DER) Elevation.** Enter the single runway number applicable to departure application criteria.

Item 4. **Field Elevation**. Enter the value of the highest point on the airport's usable runways measured in feet from mean sea level.

Item 5. **Departure Route Description**. Provide a narrative departure route description for the runway and departure route being evaluated. This narrative should agree with the specific runway narrative on AF Form 3634 departure route description.

Item 6. **Obstacle Evaluations:**

a. **Obstacle Description.** Describe controlling obstacle(s) (terrain + trees, tower, etc.) and include its AF Form 3629 number. Example: Tower/2.

b. **Obstacle Height (MSL).** Enter the height, to the nearest foot, of the controlling obstacle.

c. **Required Obstacle Clearance (ROC).** Enter the distance in NM measured along the shortest possible flight path to the obstacle within the obstacle clearance area. The distance to the obstacle will begin at the start of Section 1, which is at or abeam the runway end or edge, whichever represents the shortest flight path. The worst-case evaluation of flight path to obstacle should be performed in all cases. Allowances for precipitous terrain according to AFJMAN 11-226, paragraph 323a, should be added when judged necessary to compensate for induced altimeter errors.

d. **Minimum Height Required Over Obstacle.** Calculations are self-explanatory.

e. **Aircraft Height Over Departure End of Runway (DER) (MSL).** Initially, try zero for aircraft height over DER (AGL) unless an adjustment has previously been approved.

f. **Amount of Climb Required.** Calculations are self-explanatory.

g. **Climb Gradient (CG).** Calculations are self-explanatory.

h. **Published CG.** Self-explanatory.

Item 7. **Remarks.** Use this section for continuation of other items, if required, or for pertinent material which is not covered elsewhere. Include operational, airspace, and air traffic control restrictions or requirements that affect the design of specific departure route.

Item 8. **Calculating Distances to Turn Points Described by Altitude:**

a. **Turn Altitude.** Enter the proposed turn altitude. The turn altitude will depend on such items as aircraft performance, noise abatement, and airspace or air traffic control restrictions.

b. Required Aircraft (A/C) Altitude at DER (MSL).

Calculations are self-explanatory.

c. **Amount of Climb to Turn Point.** Calculations are self-explanatory.

d. **Distance From DER to Turn Point.** Calculations are self-explanatory.

Item 9. **Obstacle Data:**

a. **Obstacle Description.** Describe as indicated in Item 6a.

b. **Obstacle Distance.** Enter the distance in NM along the shortest possible flight path within the obstacle clearance area. The distance to the obstacle will begin at the start of Section 1. Measure perpendicular to the nearest edge of Section 1 or runway. The worst case evaluation of flight path to obstacle should be performed in all cases.

c. **Obstacle Height.** Enter the height, to the nearest foot, of the controlling obstacle.

Item 10. **ROC.** Calculations are self-explanatory.

Item 11. **Obstacle Clearance in Sections 2B and 2C.** Calculations are self-explanatory. When the altitude entered in Item 8a does not provide adequate obstacle clearance for Section 2b or 2c, rework Items 8-11 with a higher turn altitude. To select a higher turn altitude which will meet obstacle clearance, complete these steps:

a. Multiply the distance to the obstacle (Item 9b) times 48 and subtract from the MSL obstacle height (item 9c) to determine the height of the obstacle identification surface at the start of Section 2.

b. Subtract the MSL required aircraft altitude at DER (Item 8b) to determine the rise of the section 1 obstacle identification surface (OIS).

c. Divide by 152 and multiply by Section 1 climb gradient to determine the theoretical height gain in Section 1.

d. Add the MSL required aircraft altitude at DER (Item 8b) to get the MSL altitude.

e. Round the value obtained from Item 11d upward, normally to the next 100 foot increment, to get the published turn altitude. Enter this value in Item 8a and complete the remainder of the page.

When the climb gradient is 200 or less, it need not be published.

When it exceeds 200, the primary adjustment technique is to raise the turn altitude/extend the turn point. Where extending the turn point is unsatisfactory, publish the required climb gradient or redesign the departure route. The altitude the climb gradient is specified to, will be Item 11a.

A5.8. AF Form 3636, Application of Diverse Departure Criteria. This form is used to evaluate a 40:1 and a 50:1 obstacle identification surface (OIS) on runways approved for instrument departures. All three zones will be evaluated with obstacles listed by the AF Form 3629 number. Complete both sides of the form for evaluation of 40:1 and 50:1 surfaces.
Item 1-6. **Airport Information Data.** Self-explanatory.
Item 7-8. **Zones 1, 2, 3 Obstacle Evaluation Data.** Evaluate all obstacles within Zone 1, 2, and 3 areas. If required, continue obstacle evaluation on bond paper using the same format.
Item 9. **Summary of Diverse Departure Criteria.** List penetrating obstacles and follow guidance in Attachment 3 of this manual.
Item 10. **TERPS Specialist Signature and Date Prepared**.

A5.9. AF Form 3637, Instrument Approach Procedures. This form, prepared manually or by automation, shall be used to document all USAF instrument approach procedures (IAP). It provides a permanent record of data available at the time of original/amended procedural development. Complete all blocks on the form. Enter "NA" where data is not authorized/applicable. Attach computation forms (manual or automated) to AF Form 3637, as applicable. Enter AF Form 3628 and 3629 data, when available, in appropriate items.
Item 1 and 2. **Airport Information.** Self-explanatory.
Item 3. **Procedure Identification.** Enter the procedure identification according to AFJMAN 11-226, section 6. For host nation procedures, enter the identification used by host nation.
Item 4. **Airdrome Reference Point.** Enter to the nearest second. This point should be the location used to determine actual magnetic and grid variations.
Item 5. **Effective Date.** The final review authority will enter, or inform requesting unit to enter, effective date after coordination with National Imagery and Mapping Agency (NIMA). Units should coordinate with all affected air traffic control agencies for interfacing with publication cycles. Indicate if the procedure is an original or amendment. Amendments to procedures will be sequentially numbered 1 through 3 (date, Amnd 1, Amnd 2, etc.). Amendments are required for all procedural changes to the IAP. (See paragraph 2.7.3.) Amendment changes are not required for editorial corrections (AFJMAN 11-226, paragraph 142).
Item 6. **Communications.** Enter the radio call sign and primary VHF and UHF frequencies of the agency performing the function, as applicable.
Item 7. **Plan View:**

a. **Radar:**

(1) Enter radar arrival routes from the Intermediate Fix (IF) to Missed Approach Point (MAP), if Minimum Vectoring Altitude (MVA)/diverse vectors are used for the initial segment. Enter all radar arrival routes of the pre-established pattern, if a specific radar pattern is used for the initial segment.

(2) Depict FAF, MAP, step-down fix(es) (SDF) or other fixes, as applicable.

(3) Exception to MVA shall be identified as a "NOTE" in the plan view. If vectoring below MVA (according to FAAH 7110.65) is required for FAF intercept altitude, etc., then identify this application to controllers and flyability/flight inspection pilots. Example: "***NOTE:*** Exception to MVA. For PAR/ASR approach only, altitude 3100 between 15-7 NM from ASR antenna. Obstacle clearance provided by application of AFJMAN 11-226, paragraph 1042."

b. **Non-Radar (IACC #4, PS/1FA/004):**

(1) **Facilities and Fixes.** Enter the name, type, frequency or channel number, identification, emission (as required), and coordinates, to the nearest second, of each facility used in the procedure. Intersection and DME fixes used in the procedure should show the name and how formed. Show bearings and distances to facilities or fixes to the nearest degree and mile.

(2) **Transition Altitude (TA) and Transition Level (TLv).** Enter the TA and TLv on procedures as established by national authorities. (This information is needed primarily in overseas areas). Additional information can be found in FLIP General Planning.

(3) **Holding Patterns.** Depict holding patterns to include holding fix, inbound and outbound courses, direction of turn, leg lengths (If DME is used, depict DME value at end of holding pattern. If time distances are other than standard for holding altitude, indicate specific value), and if required holding altitude (mainly used on host nation procedures for ATC required holding restrictions). NOTE: If holding pattern was designed for a holding airspeed of less than 310 knots, specify the Maximum Holding Airspeed (i.e., Maximum airspeed in Holding 265 Kts).

(4) **Feeder Routing.** Transition should be those routings frequently used by air traffic control and local aircrews. Consideration for ESV should be made prior to establishing routes.

(a). **High Altitude IAP:**

1. **Outer Ring.** Depict facilities or fixes which are part of the enroute high altitude airway structure as published on the enroute high altitude chart to include routing, distance, and MEA to the IAF, holding fix, or feeder facility.

2. **Middle Ring.** Depict facilities or fixes which are not part of the enroute high altitude airway structure. Facilities that are part of the enroute low altitude airway structure and used for transition from high to low or to eliminate

ESV problems should be shown on this ring. Facilities or fixes on this ring must have a transition from a facility or fix on the outer ring. Include routing, distance, and MEA to the IAF or holding fix. Facilities on this ring must include the name, frequency/channel number, as appropriate, and identification. Fixes must show how they are formed.

(5) **IAP Depiction:**

(a) The inner ring should be drawn to scale. Range radius for low IAP is 10 NM and 20 NM for high IAP. (Recommended scale: inner ring designed on engineer ruler 60 scale with 1 NM = 10 ticks for low altitude IAPs and 5 ticks for high altitude IAPs). Normally, the IAP drawing using the NAVAID that provides final approach guidance should be centered on the center point of the inner ring. Depiction's may be offset in order to better use the plan view area. All drawings shall be oriented to true north.

(b) Include the following data, as applicable:

1. Show IAF(s), FAF, SDF(s), MAP, or other fixes, as applicable.

2. Identify the procedure's routing of all IAP segments to include headings, radials, bearings, arcs, course, procedure turn (PT), or holding pattern in lieu of PT (showing the side course).

3. Enter any controlling obstructions within 10 NM radius (low altitude) and 20 NM (high altitude) which fall in the initial, intermediate, final, circling, and missed approach areas. Other significant obstacles in or near the instrument approach area may be charted within the inner ring when deemed critical to flight safety. Explain obstacles (obstacle located near final approach area edge, excessively high terrain parallels final and intermediate boundary areas, etc.) When portrayal of several obstructions within a small area would clutter the chart, only the highest obstacle of that group need be shown. The elevation of the obstacle above mean sea level shall be shown to the nearest foot.

4. Use symbols listed in FLIP legend section of IAP charts. Symbol drawings need not be to scale; however, that should adequately portray required information to publication agencies.

5. Depict hydrographic, international boundaries, or special use airspace (SUA) features, as applicable.

Item 8. **Minimum Sector Altitude (MSA).** Define the sector(s) used for MSA(s) clockwise between bearings to the NAVAID which provide final approach guidance. Depict MSA as shown in FLIP legend section of IAP charts.

Item 9. **Vertical Velocity (V/V) Chart (Waiver Only).** Minimum climb rates shall be shown as vertical velocities in feet per minute (FPM) in 60-knot increments, from 60 knots to 300 knots or as requested. Indicate the termination altitude of published minimum climb rate. Published as a "Caution Note."

Item 10. **Field Elevation.** Enter the elevation of the highest point on the usable landing surface.

Item 11. **Touchdown Zone Elevation.** Enter the highest elevation in the first 3000 feet of the approach end of the runway.

Item 12. Profile:

a. **Radar:**

(1) Same information as Item 7a(1). Identify the procedure's routing in all segments to include headings, radials, bearings, arcs, and courses.

(2) Depict IAF if specific radar pattern is used; IF, FAF, MAP, SDF(s), or other fixes, as applicable, with associated altitude information as shown in FLIP legend section of IAP charts.

(3) For PAR procedures, indicate glidepath angle and threshold crossing height (TCH).

(4) Depict ASR recommended altitudes and distances across the top portion of the profile. Compute altitude information according to AFI 13-203.

(5) Indicate FAF to MAP and MAP to runway distance as shown on FLIP IAP charts.

(6) Missed approach instructions are not required in the profile section.

b. **Non-Radar:**

(1) Same information as in Item 7b(4)(b)1 and 2.

(2) Include associated altitude information with fixes listed in (1).

(3) Enter Visual Descent Point (VDP) DME value used to establish VDP.

(4) For ILS procedures, indicate glideslope (GS) angle, TCH, GS interception altitude, and height of the GS at localizer FAF. For CAT II procedures, indicate the radar altimeter (RA) at DH point.

(5) Indicate FAF to MAP and MAP to runway distances as shown on FLIP IAP charts. For CAT II ILS procedures, indicate distances between DHs and runway threshold in feet.

(6) Missed approach instructions are not required in the profile section except when the form is used as the sole support for exercise or actual contingency operations.

(7) Transition Altitude (TA) and Transition Level (TLv). Enter the TA and TLv on procedures as established by national authorities. (This information is needed in overseas areas). Give the transition altitude(s) to the nearest 100 feet and flight level as specified. Additional information can be found in FLIP General Planning.

Item 12. **Airdrome Sketch.** (Used only for exercises/contingency operations). Drawing need not be to scale. Draw the runway and depict its length and width as shown on FLIP IAP charts. Indicate approach lighting identification, Visual Glideslope Indicator (VGSI), and runway lighting as shown on FLIP IAP charts and according to AFJMAN 11-226, appendix 5.

Item 13. **Minimums:**

(a) Under CAT/APP, enter procedure name (ILS-36, LOC-36, TAC-36, CIR, etc.).

(b) Enter MDA or DH, as appropriate; RVR (if not available, enter prevailing visibility); HAT or HAA; and ceiling and visibility for each category. Categories may be combined when none of the minima elements differ. Enter "NA" where minima are not authorized/applicable. Overseas TERPS offices need to add no light minima in remarks section of approach plate for non-DoD locations.

Item 14. **Magnetic (MAG)/GRID Variation (Actual).** Enter the assigned magnetic variation for the area. The assigned magnetic variation should indicate the nearest future Epoch Year value. Enter the Epoch Year of the variation value (8°W/1995). If the station is north of 67 degrees North, give the magnetic grid variation to the nearest degree.

NOTE: (See AFPAM 11-21, for computation of grid data.) The magnetic variation of record and the assigned variation used to slave the NAVAID may be different. Projected magnetic variation and variation of record can be obtained from MAJCOM.

Item 15. **NAVAID Assigned MAG/Grid Variation (Slave).** Enter current assigned variation obtained from the FAA Master Data Summary listing. This information can be obtained from the MAJCOM. Enter the current ASR oriented variation value. (This information can be obtained from maintenance personnel by direct reading of equipment or from ATCALS eval report.)

Item 16. **Time/Distance Table.** Enter minutes and seconds in the table based on FAF to MAP distance displayed in the profile section. Compute data as follows: (Distance X 60) divided by Knots = Minutes and Fraction. Fraction X 60 = seconds.

Item 17. **Precision Data.** Enter runway number, GPI, RPI, TCH, and GS angle for precision approaches. Enter VGSI RRP for all procedures. ***NOTE:*** For TCH determination, see AFJMAN 11-226, paragraph 936. Enter TCH information to the nearest hundredth of a foot and publish to the nearest foot.

Item 18. **Approach Information.** Enter the bearing and distance from the FAF to the MAP. Enter the missed approach instructions describing the missed approach in detail (include missed approach track, altitude, holding and other instructions, as applicable). If the MAP is based on time and distance, enter the FAF to MAP times in item 16. If a missed approach climb gradient is required, enter the vertical velocity (V/V) in Item 9.

Item 19. **Approach/Missed Approach Radials Selected.** List the radials for the initial, intermediate, final and missed approach selected for flight inspection of the IAP.

Item 20. **Additional Information:**

a. The ESV block is to serve as a reminder to request expanded service volume checks when established service limitations (FAAH 7110.65) are exceeded. ESV checks apply to distance and altitude. The ESV check may be required not only for terminal NAVAIDs, but also for feeder facilities as well. The appropriate frequency managers must check for possible co-channel interference and flight inspection must determine the adequacy of the signal. The NAVAID classifications and service volume of each are listed in FLIP.

b. Airspace requirements are according to this publication.

Item 21. **Waivers.** List any waivers required for new or amended procedures. List the number of approved waivers on file for amended procedures and the approval date for each. Waiver requests and approvals should support each affected procedure.

Item 22. **Airfield/NAVAID Data.** Enter the coordinates for the approach and departure end of the runway serving the procedure. Enter the coordinates for the NAVAID (primary) which provides final approach guidance. Enter coordinates for secondary (GS antenna) or other NAVAIDs, as appropriate. This information should agree with data on AF Form 3628.

Item 23. **Obstacle Data.** Identify obstacles to include:

a. **Segment.** Initial, intermediate, final, missed approach, circling. Identify all SDFs used. FINAL (FAF-SDF) on one line followed on the next line with FINAL (SDF-MAP). List obstacles which are portrayed due to Flight Safety Determination (FSD).

b. **Controlling Obstacles.** Describe obstacle (terrain + trees, tower, etc.) and include its AF Form 3629 number.

c. **Elevation and Coordinates.** Enter MSL elevation of obstacle to the nearest foot. Enter location of obstacles by latitude and longitude to the nearest second. Extract this data for AF Form 3629 or indicate source of information above coordinates (JOG NM 14-2).

Item 24. **Holding Data.** List all holding patterns on IAP. Include:

a. NAVAID name and identification.

b. Radial or bearing and DME, if applicable. If DME not derived from a co-located source, identify source.

c. List template number based on maximum holding altitude used by ATC and holding direction (to and from NAVAID, not holding fix).

d. List maximum holding altitude used by ATC. Normally allow for holding of three aircraft at a holding fix.

e. Indicate maximum airspeed (A/S) utilized in holding.

f. Identify controlling obstacle across the top of block and include coordinates below identification.

g. Enter location of obstacles by latitude and longitude to the nearest second.

h. Indicate minimum holding altitude. List ROC value if other than 1000 feet.

Item 25. **Minimum Sector Altitude(s) (MSA).** Define the sector(s) used for MSA clockwise between bearings to the NAVAID. MSA defined here should agree with the depiction in Item 8. Data entered shall agree with AF Form 3629. MSA minimum altitude is obstacle plus 1000 feet ROC. NIMA will verify this data.
Item 26. **Emergency Safe Altitude (ESA).** ESA is approved by MAJCOM.
Item 27. **Feeder Routes.** List the feeder routing required by procedure. If minimum reception altitude (MRA) is required, document rationale in remarks.
Item 28. **Visual Aids.** Enter the type and length of approach lights used for reduced visibility. Enter the type and spacing of runway lights used for RVR eligibility. Indicate (yes/no) if touchdown zone and centerline lighting are available. Enter VGSI GS angle.
Item 29. **No-Light Visibility.** Enter the no-light visibility values. If a credit for lights was taken in accordance with AFJMAN 11-226 paragraph 343, a note shall be published on the approach plate (normally in the remarks section) indicating increase required. (Example: When ALS inop, increase visibility for CAT ABD ½ mile, CAT C ¼ mile).
Item 30. **ASR Recommended Altitudes.** Enter the recommended altitudes for surveillance approaches. Compute recommended altitudes according to paragraph 3.23 this manual.
Item 31. **Remarks.** The remarks section is used to expand or explain any items on the form. Explanations should be concise and identify specific affected items on this form or a specific paragraph reference in regulations pertaining to IAP criteria. Use bond paper to continue remarks and attach it to the form.
Item 32. Procedure Requester(s). Enter the agency (unit/office symbol) and date of the request for IAP development. This information will be used by MAJCOM TERPS Branch to maintain IAP OPR listing.
Item 33. Same as Item 3.
Item 34. Approval Signatures.
Item 34 A-B. Flight Check. Obtain the flyability and flight inspection pilot's signatures. If the IAP was developed using NAVAIDs not maintained or flight inspected by a US agency, enter a statement in the flight inspection pilot block to denote the agency (or country) performing the flight inspection of the facility and, if available, the date of the last inspection.
Item 34 C. Approving Authority Signatures. All signature blocks shall be signed, as required. MAJCOM signatures are only required for waivers to IAPs (figure 2.2). Include an explanation when signatures cannot be obtained.

A5.10. AF Form 3639, Precision Computations. This form is used to calculate PAR and ILS precision data and compute approach minimums.
Item 1. **Computation Relationships.** Self-explanatory.
Item 2. **Computation Data.** Enter the proper data for a PAR or ILS approach. Extract data from AF Form 3628. Glideslope (GS) is the selected GS based on obstacles from the computations. Ground Point intercept (GPI), Runway Point intercept (RPI), and Threshold Crossing Height (TCH) are computed using the formula data in AFJMAN 11-226, appendix 2, figures 129, 129A, and 129B.
Item 3. **Desired Minimum Glideslope Based on Zone 1.** DH determined by adding a minimum (AFJMAN 11-226, paragraphs 938 and 1028) or higher HAT to TDZE. Since precision computations are based on height above threshold elevation, the selected or desired HAT value must be corrected if touchdown and threshold elevation differ.
Item 4. **Minimum GS Based on Total Final Approach.** Required Obstacle Clearance (ROC) is established according to AFJMAN 11-226, paragraphs 931-934 (figure 77) or paragraphs 1021-1024 (figure 99). Calculations: self-explanatory.
Item 5. **Selection of Glideslope Angle.** This data entry is self-explanatory. If the GS angle required by obstacles from, Steps 3 and 4 is greater than 3 degrees, a 3 degree angle may be selected, provided that the DH is increased. When the selected GS angle is different than the angle used for computations in Step 4, Step 4 shall be repeated using the selected angle.
Item 6. **Adjustment for Obstacle Penetration.** This is the first step in adjusting the DH for obstacle penetrations. It is also used to adjust the distance needed to displace the runway threshold for obstacles penetrating the final approach surfaces. Calculations are performed according to AFJMAN 11-226, appendix 2, paragraph 11. Compute ROC for Zone 1, 2, and 3 according to AFJMAN 11-226, appendix 2, paragraph 11b. Length of runway and cost of moving approach lights must be considered when displacing the runway threshold. Relocating GPI (moving the touchdown reflector or GS antenna) is another solution to adjustment for obstacle penetration; however, the calculations are more involved than the form allows. If this solution is desired, request information from MAJCOM.
Item 7. **DH Adjustment.** The DH must be adjusted to the height that would apply if the obstacle were far enough away from the GPI that it would not penetrate the obstacles surface for the GS. The adjusted DH must allow for a HAT no lower than 250 feet, except for obstacles located in the PAR/ILS transitional surfaces (AFJMAN 11-226, paragraphs 938 and 1028). If the HAT is higher than 250 feet, add 250 to the obstacle height and use DH for a 250 foot ROC (or use the adjusted DH, if it is lower). A DH greater than 250 feet above the obstacle's height is not required.
Item 8. **Location of DH for Missed Approach.** In this calculation, locate the point where DH intercepts GS (the DH point/MAP, AFJMAN 11-226, paragraph 324). Use HAT calculated in Item 7 (if DH was adjusted) or the selected value in

Item 4. Since precision calculations are based on threshold elevation, the HAT must be corrected when touchdown zone and threshold elevations differ.

Item 9. **DH Based on Missed Approach Segment.** The DH also provides clearances over obstacles in the missed approach area. The calculation format is self-explanatory. If the adjusted DH does not allow clearance of the missed approach surface, repeat the calculation to make sure the DH is increased appropriately. A different DH could be required for each category of aircraft making a turning missed approach because of the different obstacle clearance areas required. In this case, make the computation in Item 9 and show this in the remarks section of this form. Because an increase in the DH also causes an increase in the distances from the GPI to the DH point (which, in turn, increases the size of the final approach Zone 1), repeat the calculations in Item 4. If a combination straight and turning missed approach is necessary, refer to AFJMAN 11-226, paragraph 945 and 1035 and figures 82 and 102.

Item 10. **Missed Approach Climb Gradient.** If the DH increases in Item 9 results in minima higher than that required, missed approach obstacles may be covered by a climb gradient higher than the 152 feet per NM standard and the final approach DH retained. A combination DH increase and climb gradient may be used. Use Item 9 and 10 formats, each showing the amount of penetration covered by that option. Explain the combined DH increase and climb gradient in the remarks section.

NOTE: An increase in the standard climb gradient requires a waiver to AFJMAN 11-226.

Item 11. **ILS OM/FAF Altitude.** Calculations are self-explanatory.

Item 12. **Glideslope Intercept Point.** Calculations self-explanatory.

Item 13. H**AT Computation.** Calculations self-explanatory.

Item 14. **Ceiling.** Calculations self-explanatory.

Item 15. **Visibility.** No-light visibility is based on HAT as shown in the no-light column in the precision portion of AFJMAN 11-226, table 10.

a. When the HAT is greater than 250 feet, the no-light visibility is the distance (SM) from DH point to end of runway (EOR). The DH point to EOR distances (SM) should be checked even when the HAT is 250 feet or less because, in rare instances (depending on GPI location and runway slope), this distance can be greater than the no-light values in AFJMAN 11-226, table 10.

b. Before reducing visibility for lights, check AFJMAN 11-226 paragraphs, reference operational conditions. When visibility credit for lights is allowed, the visibility may be read directly from AFJMAN 11-226, table 10.

c. When the HAT is greater than 250 feet, the non-precision portion of AFJMAN 11-226, table 10, applies. If no-light visibility is greater than 1 SM, AFJMAN 11-226, paragraph 343d, is used. If DH is adjusted in Item 7 for a final approach obstacle (AFJMAN 11-226, paragraph 332), obstacle surfaces must be checked.

d. The controlling visibility is the highest in the column for each aircraft category. If RVR requirements are met, enter appropriate RVR values for each category.

Item 16. **Minima.** Enter the controlling values from Items 4-14. Show these values in the FLIP minimum section format. If a host nation procedure is being validated, show the host minima here. Minima may be combined for categories when no differences exist. The highest minima (AFJMAN 11-226/APATC-1/foreign nation) shall be entered in the minima section of AF Form 3637 (Item 13).

REMARKS. This section is used to expand on, or explain any item(s) on the form. It may be continued on plain bond paper, if required. Explanations/Calculations should be concise and identify affected items or a specific paragraph reference in a regulation pertaining to data herein.

A5.11. AF Form 3640, Nonprecision Computations. This form is used to determine Minimum Descent Altitude (MDA) for non-precision approaches (i.e., TACAN, VOR, localizer).

Item 1. **MDA Based on Final Approach Segment.** Space is available to compute two types of approaches, when a combined approach is being designed. The computation format is self-explanatory. Use the ROC value given in the proper chapter in AFJMAN 11-226 for the type of approach.

Item 2. **MDA Based on Missed Approach.** The MDA also provides clearance over obstacles in the missed approach area. The calculation format is self-explanatory. A different MDA could be required for each category of aircraft making turning missed approach because of the different obstacle areas encountered. In this case, make the computations shown in Item 2 and enter obstacle data in the remarks section. If an obstacle penetrates the obstacle surface, the MDA must be increased or a climb gradient provided. If a combination straight and turning missed approach is required or desired, refer to AFJMAN 11-226.

Item 3. **Adjusted MDA if Penetration Exists.** Calculations are self-explanatory.

Item 4. **Missed Approach Climb Gradient Required for Item 1 MDA.** If the MDA value from Item 3 results in a minima higher than that required, missed approach obstacles may be covered by a climb gradient higher than the 152 feet per NM standard and the Item 1 MDA retained.

NOTE: If necessary, a combination of Item 3 MDA and Item 4 climb gradient may be used. In this case, use the Item 3 and Item 4 formats to show the amount of penetration covered by each option and explain, in remarks section how they were combined. An increase to the standard climb gradient requires a waiver to AFJMAN 11-226.

Item 5. **HAT Computation.** Calculations are self-explanatory.

Item 6. **Ceiling.** Calculations are self-explanatory.

Item 7. **Visibility Without Approach Lights.** The computation format is self-explanatory.

Item 8. **Visibility with Approach Lights.** Visibility may be reduced if approach lights are available and the operational conditions in AFJMAN 11-226 are met. Use the format on the form to determine visibility with approach lights. Enter the RVR value (if any) for each aircraft category.

Item 9. **Minima.** Enter the controlling values from the Items 1-8. Show these values in the FLIP minimum section format. If a host nation procedure is being validated, show the host minima here. Minima may be combined for categories when no differences exist. The highest minima (AFJMAN 11-226/APATC-1/host nation) shall be entered in the minima section of AF Form 3637 (Item 13).

Item 10. **Changes to Published Minima Without Approach Lights.** Enter only the changes which will be made to establish no-light minima.

Remarks. This section is used to expand or explain any item(s) on the form. It may be continued on plain bond paper, if required. Explanations/Calculations should be concise and identify specific items or a specific paragraph reference in a regulation pertaining to data herein.

A5.12. AF Form 3641, VDP Computation Worksheet. This form is used for determining the VDP for runways with or without Visual Glide Slope Indicator.

Item 1,2,& 3. Self-explanatory.

A. Computation Information Values. Enter all information values here.

B. Determination of VDP. Calculation format is self-explanatory.

Item 4. **Termination of VDP Obstacle Surface.** The VDP obstacle area terminates at the VDP, or at the point where the VDP surface height equals the MDA minus the ROC (plus adjustments) used in the final approach segment, whichever occurs closer to the runway. The calculation format is self-explanatory.

Item 5. **Obstacle Clearance Determination.** Calculation format is self-explanatory. If an obstacle penetrates the VDP obstacle surface, the VGSI angle or descent gradient from the MDA to the runway must be increased or a waiver requested.

Item 6. As needed.

Item 7. **Determination of VDP.** The calculation format is self-explanatory.

Example:

859.00 (O) Facility distance to Rwy centerline.
divided by
.08169 (T) Tangent of 4.67^{o} (355.67 True Rwy Hdg)
-(351.00 True Final Apch Course)
4.67^{o}
= 10515.36 (A) Distance Facility to Point of Intercept (POI)
- 7101.85 "X" value of facility to EOR
= 3413.51 EOR to POI
6167.90 Distance VDP to EOR
- 3413.51 EOR to POI
= 2754.39 POI to VDP
x.08169 (T)
= 225.01 Rwy centerline to Final Apch Course
+ 859.00 Facility distance to Rwy centerline
= 1084.01 Adjusted "O"

(square root)$(7101.85 + 6167.9)^2 + 1084.01^2$ = 13313.95/6076.1 = 2.19(2.2 DME)
or (7101.85 + 6167.9)/cos 4.67 = 13313.95/6076.1 = 2.19(2.2 DME)

A5.13. AF Form 3642, Circling Computations. This form is used to determine circling minimums based on obstacle clearance or height above airport (HAA).

Include the airport name and names of instrument procedures applicable to specific circling computations in block provided.

Item 1. **Circling Minimum Descent Altitude (CMDA) Based on Obstacle Clearance.** Controlling Obstacle Height. Ensure the expanded circling area obstacle is considered when sector(s) have been eliminated from circling obstacle clearance. The highest obstacle in the circling or expanded obstacle clearance shall be used.

Item 2. **CMDA Based on Minimum HAA.** Calculations are self-explanatory.

Item 3. **Ceiling.** Calculation are self-explanatory.

Item 4. **Visibility.** Calculations are self-explanatory.

Item 5. **Minima.** Show these values in the FLIP minima section format. The highest minima shall be entered in the minima section of AF Form 3637 (Item 13).

A5.14. AF Form 3979, MMLS TERPS Computations. This form is used to calculate the distance from the DH to threshold, determine the TCH, and location of the GPI.
Item 1. **General Information.** Information that will be needed for calculations and results of the calculations.
Item 2. **Establishment of MAP (DH).** Calculations are self-explanatory.
Item 3. **Calculation of TCH.** Calculations are self explanatory.
Item 4. **Calculation of GPI.** Calculations are self-explanatory.

A5.15. AF Form 3980, Instrument Procedure Waiver. This form is used to submit for a waiver to established criteria applicable to Instrument Procedures. Items 1 through 5 must be answered completely and accurately.
Item 1. **Procedure Name.** Self-explanatory.
Item 2. **Specific Directive and Paragraph To Be Waived.** Self-explanatory. Additionally, define what is creating the violation of criteria (i.e., AFJMAN 11-226, paragraph 1022, for penetration of the 7:1 transitional surface by obstacles #214, 407, 408, and 412-415, listed on AF Form 3637).
Item 3. **Reason For Waiver (Justification) and Operational Impact If Not Approved.** Justify the need for the waiver and state the operational impact if the waiver is not approved. When stating the operational impact, be specific (i.e., Historical weather data shows that Ceilings and Visibility's below 500 feet and 2 miles occur approximately 95 days per year. This translates into the loss of , at approximately 10 sorties a day, 950 sorties per year, seriously degrading our mission readiness and training ability).
Item 4. **Alternative(s) Considered and Reason For Rejection.** Explain each alternative considered used to eliminate the need for the waiver and state why they were not acceptable.
Item 5. **Equivalent Level of Safety Provided.** An equivalent level of safety ***must*** be established for every waiver request to ensure that Safety of Flight is maintained. An Equivalent level of safety can be defined as a compensating measure to insure that the deviation from criteria does not have an adverse effect on the operation of aircraft. An example could be a warning note published on the procedure to have pilot configure his aircraft for landing at a designated point due to a shorter than standard intermediate segment.
Item 6. **Submitted By.** Self-explanatory.
Item 7. **MAJCOM TERPS (Comments).** The MAJCOM TERPS Office will be the first in line to recommend approval or disapprove the waiver request. If the waiver is not approved, reason for disapproval must be stated in the "Comments" block. ***NOTE:*** The first "disapproval" will end the processing phase and the package will be returned through the coordination chain.
Item 8. **MAJCOM FLYING OPERATIONS (Stan/Eval) ENDORSEMENT.** This endorsement is to ensure that the MAJCOM flying personnel have the opportunity to review the waiver to determine if there is any reason that this waiver should not be approved. If the waiver is not approved, reason for disapproval must be stated in the "Comments" block.
Item 9. **HQ AFFSA ACTION.** HQ AFFSA is the final waiver approving authority. If the waiver is not approved, reason for disapproval must be stated in the "Comments" block.

A5.16. AF Form 3981, GPS/RNAV Descent Angle and Surface Evaluations. This form is used to determine the descent angle from the Final Approach Fix (FAF) altitude to a point 50 feet above the threshold for Straight-In approaches. This criteria is established in AFJMAN 11-226, paragraph 1523f. Descent Angles will not be published if the Missed Approach Waypoint (MAWP) is not located over the threshold.
Item 1. **Descent Angle.** Calculations are self- explanatory.
Item 2. **Obstacle Identification Surface Angle.** Calculations are self-explanatory.
Item 3. **Horizontal Distance MDA to Threshold.** Calculations are self-explanatory.
Item 4. **Stepdown Fix.** If a Stepdown Fix (SDF) is used, complete this section to determine if the SDF altitude permits the publication of a Descent Angle.
Item 5. **Length of OIS Surface.** Calculations are self- explanatory.
Item 6. **Obstacle Evaluation In OIS Surface Area.** Calculations are self-explanatory. NOTE: A Descent Angle is not published if the OIS Surface Area is penetrated.

A5.17. AF Form 3982, GPS/RNAV Combination Straight and Turning Missed Approach Length of Segment 1. This form is used to determine the turn starting point (Length of Section 1) in the Missed Approach Segment when a Combination Straight and Turning method is used. Calculations are self-explanatory.

A5.18. AF Form 3992, Instrument Procedure Flyability Check, Instrument Approach Procedure (IAP). The instruction and example of this form is located in Attachment 9.

A5.19. AF Form 3992, Instrument Procedure Flyability Check, Standard Instrument Departure Procedure (SID). The instruction and example of this form is located in Attachment 9.

A5.20. (ADOPTED) FAA Form 6050-4, Expanded Service Volume (ESV) Request (See paragraph 3.24 for instructions on obtaining this form)**.** NAVAID service volume limitations are listed in FAA 8260.19/FAAH 7110.65 and frequency management guidance in FAA Order 6050.5, Frequency Management Engineering Principles. Coordinate with MAJCOM prior to submitting an ESV request(s). MAJCOM shall validate the requirement for ESV. Complete this form IAW FAAO 8260.19, Chapter 9. The Regional Spectrum Management Office (SMO) shall determine if the desired frequency protections can be guaranteed. They will also do an engineering analysis to see if the signal strength, provided at the worst case points of the service volume, complies with spectrum management minimum principle requirements. SMO will indicate approval or provide alternatives to limitations for ESV checks. Flight inspections will be performed to confirm engineering analysis and to determine that a usable, interference free signal is available throughout the desired volume of airspace. When ESV approval is completed by all agencies, file the request with all affected procedures. When there is no longer a requirement for an established ESV, the originating office shall cancel it and notify all concerned agencies. ESVs shall be reviewed at least once a year to validate the requirement. FAA Flight Inspection Office's (FIO) are listed in FAAO 8260.32, Appendix 2.

A5.21. (ADOPTED) FAA Form 8240.22, Facility Data Sheets Request (See paragraph 3.24 for instructions on obtaining this form)**.** The instructions for these forms are available in FAAO 8240.36.

A5.22. (ADOPTED) FAA Form 8260-2, Radio Fix and Holding Data Record Request (See paragraph 3.24 for instructions on obtaining this form)**.** The instructions for this form are located in FAAO 8260.19, Chapter 9.

Figure A5.1. Obstacle Identification Area (OIA) -- Obstacles Within 10 NM of ARP.

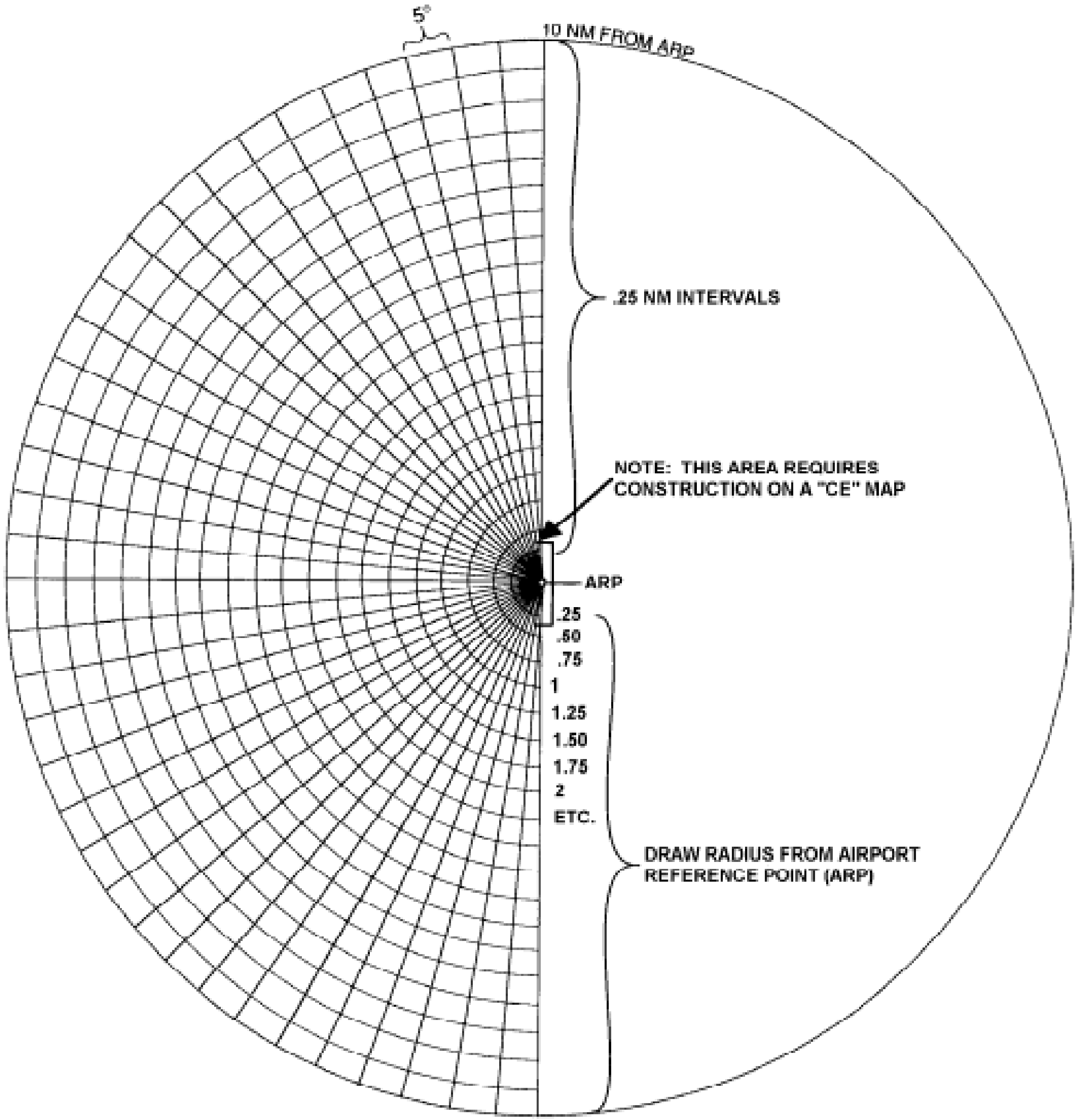


Figure A5.2. OIA -- 10 NM to 30 NM Area.

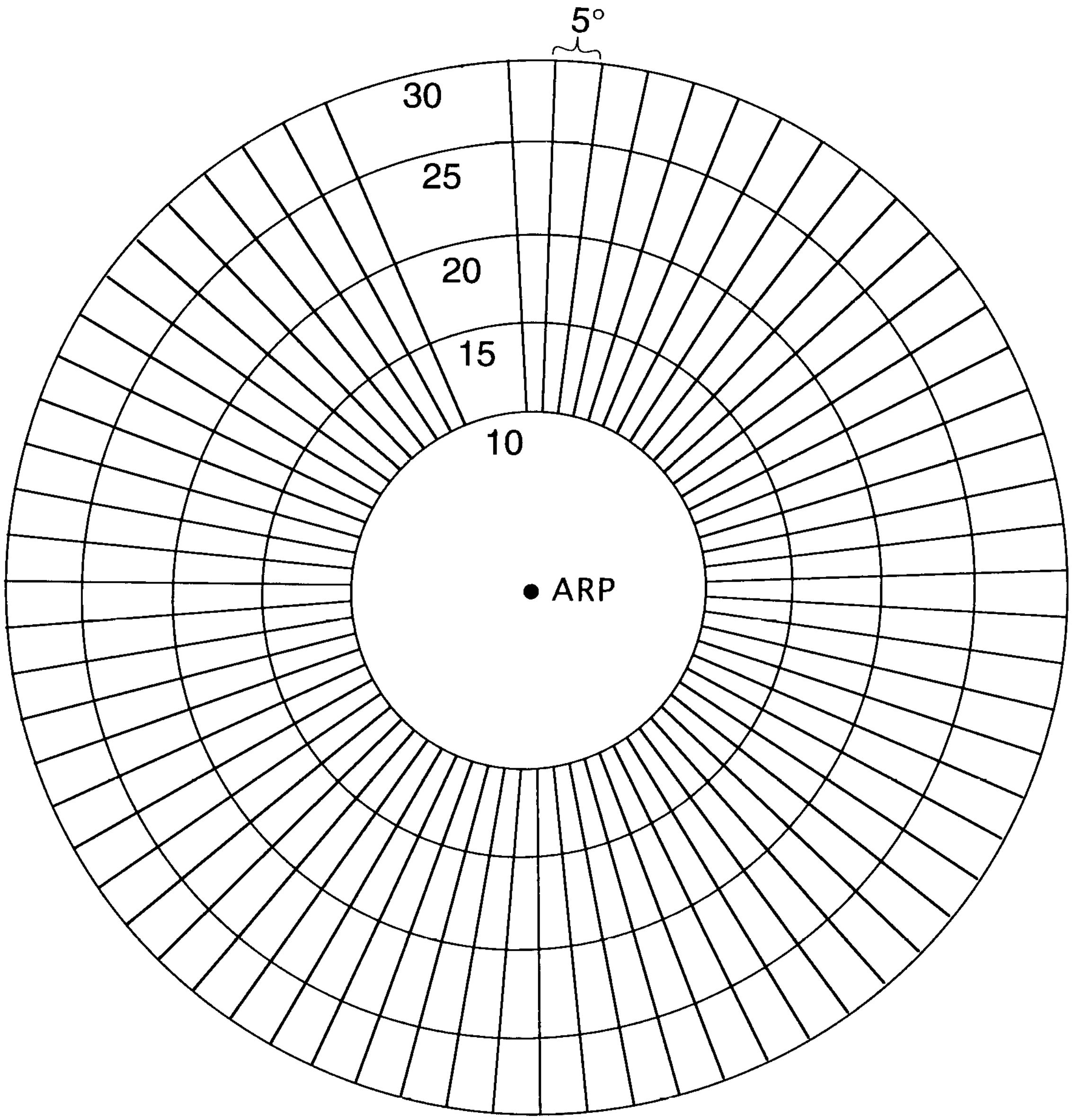


Figure A5.3. OIA -- 30 NM to 60 NM Area.

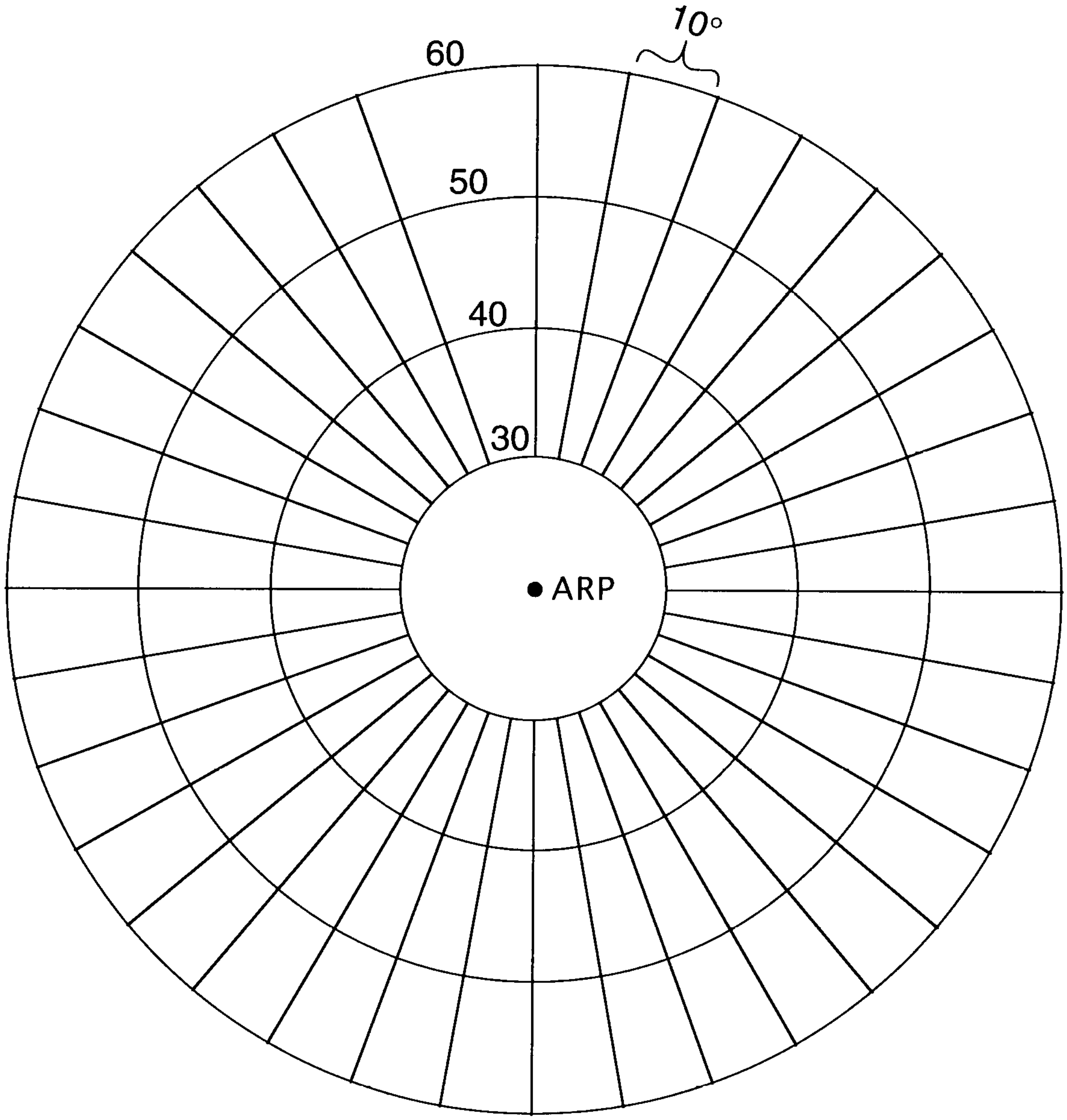


Figure A5.4. OIA - 60 NM to 105 NM Area.

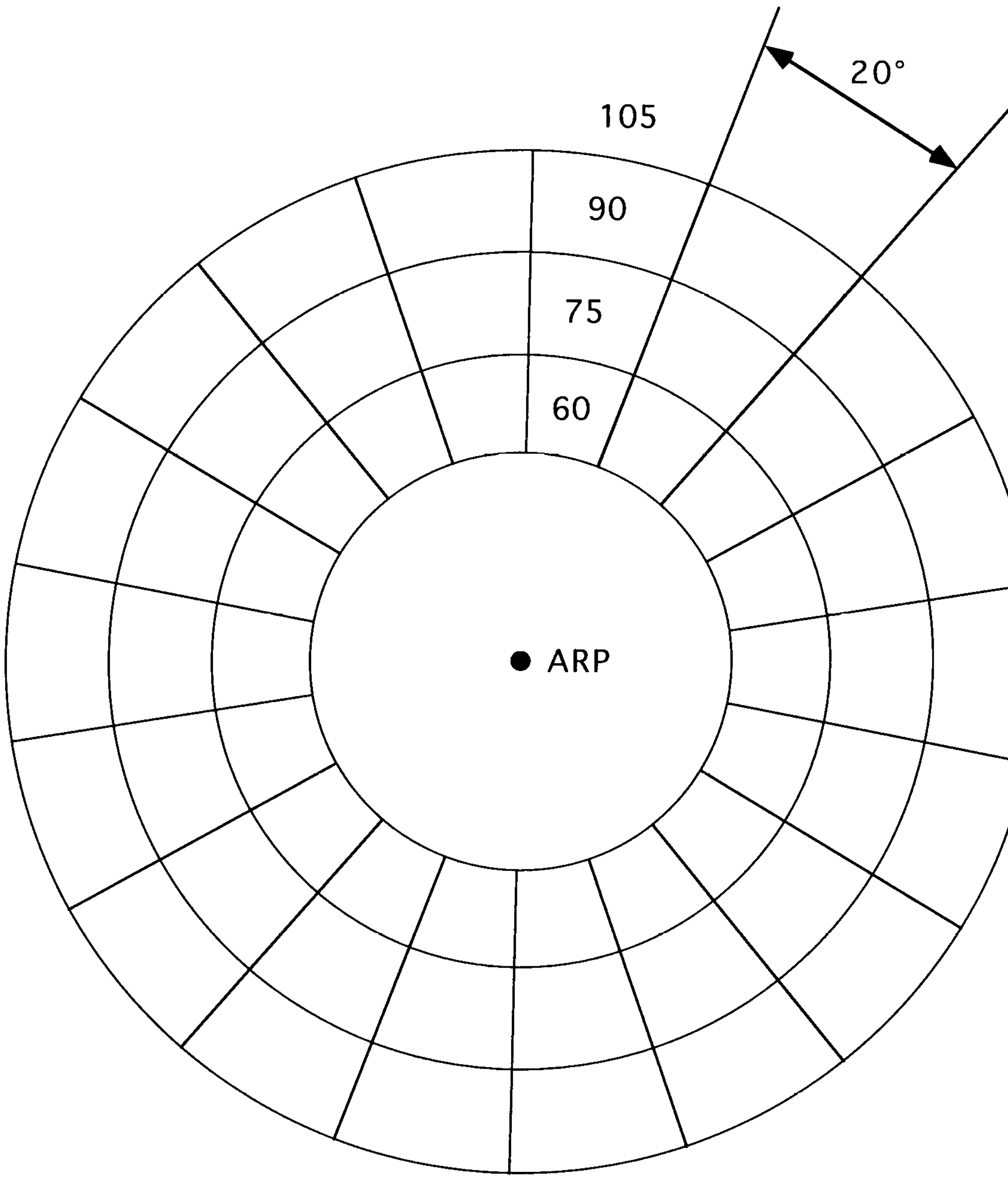


Figure A5.5. Chart Scales and Equivalents.

CHART SCALES AND EQUIVALENTS

FRACTIONAL SCALE	MILES PER INCH		INCHES PER MILE		FEET PER INCH
	NAUTICAL	STATUTE	NAUTICAL	STATUTE	
1:500	0.007	0.008	145.83	126.72	41.67
1:600	0.008	0.009	121.52	105.60	50.00
1:1,000	0.014	0.016	72.91	63.36	83.33
1:1,200	0.016	0.019	60.76	52.80	100.00
1:1,500	0.021	0.024	48.61	42.24	125.00
1:2,000	0.027	0.032	36.46	31.68	166.67
1:2,400	0.933	0.038	30.38	26.40	200.00
1:2,500	0.934	0.039	29.17	25.34	208.33
1:3,000	0.041	0.047	24.30	21.12	250.00
1:3,600	0.049	0.057	20.25	17.60	300.00
1:4,000	0.055	0.063	18.23	15.84	333.33
1:4,800	0.066	0.076	15.19	13.20	400.00
1:5,000	0.069	0.079	14.58	12.67	416.67
1:6,000	0.082	0.095	12.15	10.56	500.00
1:7,000	0.096	0.110	10.42	9.05	583.33
1:7,200	0.099	0.114	10.13	8.80	600.00
1:7,920	0.109	0.125	9.21	8.00	660.00
1:8,000	0.110	0.126	9.11	7.92	666.67
1:8,400	0.115	0.133	8.68	7.54	700.00
1:9,000	0.123	0.142	8.10	7.04	750.00
1:9,600	0.132	0.152	7.60	6.60	800.00
1:10,000	0.137	0.158	7.29	6.34	833.33
1:10,800	0.148	0.170	6.75	5.87	900.00
1:12,000	0.165	0.189	6.08	5.28	1,000.00
1:13,200	0.181	0.208	5.52	4.80	1,100.00
1:14,400	0.197	0.227	5.06	4.40	1,200.00
1:15,000	0.206	0.237	4.86	4.22	1,250.00
1:15,600	0.214	0.246	4.67	4.06	1,300.00
1:15,840	0.217	0.250	4.60	4.00	1,320.00
1:16,000	0.219	0.253	4.56	3.96	1,333.33
1:16,800	0.230	0.265	4.32	3.77	1,400.00
1:18,000	0.247	0.284	4.05	3.52	1,500.00
1:19,200	0.263	0.303	3.80	3.30	1,600.00
1:20,000	0.274	0.316	3.65	3.17	1,666.67
1:20,400	0.280	0.322	3.57	3.11	1,700.00
1:21,120	0.290	0.333	3.45	3.00	1,760.00
1:21,600	0.296	0.341	3.38	2.93	1,800.00
1:22,800	0.313	0.360	3.20	2.78	1,900.00
1:24,000	0.329	0.379	3.04	2.64	2,000.00
1:25,000	0.343	0.395	2.92	2.53	2,083.33
1:31,680	0.434	0.500	2.30	2.00	2,640.00
1:48.000	0.658	0.758	1.52	1.32	4,000.00
1:50,000	0.686	0.789	1.46	1.27	4,166.67
1:62,500	0.857	0.986	1.17	1.01	5,208.33
1:63,360	0.869	1.000	1.15	1.00	5,280.00

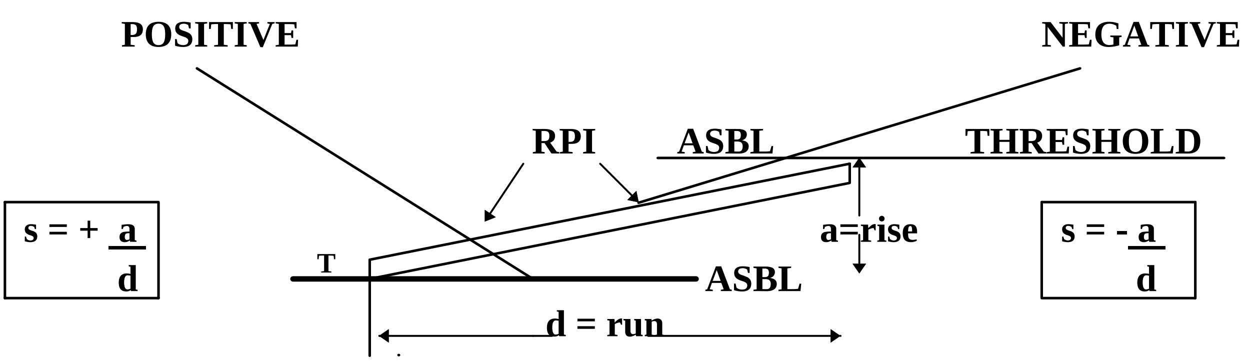
FRACTIONAL SCALE	MILES PER INCH		INCHES PER MILE		FEET PER INCH
	NAUTICAL	STATUTE	NAUTICAL	STATUTE	
1:75,000	1.029	1.184	0.97	0.85	6,250.00
1:96,000	1.317	1.515	0.76	0.66	8,000.00
1:100,000	1.371	1.578	0.73	0.63	8,333.33
1:125,000	1.714	1,973	0.58	0.51	10,416.67
1:126.720	1.738	2.000	0.58	0.50	10,560.00
1:200,000	2.743	3.157	0.36	0.32	16,666.67
1:250,000	3.429	3.946	0.29	0.25	20,833.33
1:253,440	3.476	4.000	0.29	0.25	21,120.00
1:400,000	5.486	6.313	0.18	0.16	33,333.33
1:500,000	6.857	7.891	0.15	0.13	41,666.67
1:506,880	6.952	8.000	0.14	0.13	42,240.00
1:750,000	10.286	11.837	0.10	0.08	62,500.00
1:1,000,000	13.715	15.783	0.07	0.06	83,333.33
1:1,013,760	13.904	16.000	0.07	0.06	84,480.00
1:1,500,000	20.572	23.674	0.05	0.04	125,000.00
1:1,680,000	23.041	26.515	0.04	0.04	140,000.00
1:2,000,000	27.430	31.565	0.04	0.03	166,666.67
1:2,500,000	34.287	39.475	0.03	0.03	208,333.33
1:3,000,000	41.145	47.348	0.02	0.02	250,000.00
1:3,500,000	48.002	55.240	0.02	0.02	291,666.67
1:4,000,000	54.860	63.131	0.02	0.02	333,333.33
1:4,500,000	61.717	71.023	0.01	0.01	375,000.00
1:5,000,000	68.575	78.914	0.01	0.01	416,666.67
1:6,000,000	82.290	94.697	0.01	0.01	750,000.00
1:7,000.000	96.005	110.479	0.01	0.01	833,333.33
1:8,000.000	109.719	126.262	0.01	0.01	916,666.67
1:9,000,000	123.434	142.045	0.01	0.01	1,000,000.00
1:10,000,000	137.149	157.828	0.01	0.01	1,083,333.33
1:11,000,000	150.864	173.611	0.01	0.01	1,116,666.67
1:12,000,000	164.579	189.393	0.01	0.01	1,250,000.00
1:13,000.000	178.294	205.176			1,333,333.33
1:14,000,000	192.009	220.959			1,416,666.67
1:15,000,000	205.724	236.742			1,500,000.00
1:16,000,000	219.439	252.525			1,583,333.33
1:17,000,000	233.154	268.308			1,666,666.67
1:18,000,000	246.869	284.090			1,750,000.00
1:19,000,000	260.584	299.373			1.833,333.33
1:20,000,000	274.299	315.656			1,916.666.67
1:21,000,000	288.014	331.439			1,750,000.00
1:22,000,000	301.728	347,222			1,833,333.33
1:23,000,000	315.443	363.005			1,916,666.67
1:24,000.000	329.158	378.787			2,000,000.00
1:25,000,000	342.873	394.570			2,083,333.33
FORMULAS	SCALE / 72913 24	SCALE / 63.360	72913 24 / SCALE	63,360 / SCALE	SCALE / 12

TERMINAL INSTRUMENT PROCEDURES GUIDE

NOTE: This attachment provides terminal instrument procedures (TERPS) specialists with AFJMAN 11-226 quick reference calculations/formulas and guidance for using maps and charts in developing instrument procedures.

A6.1. GPI, RPI, TCH Calculations. AFJMAN 11-226 provides the procedures specialist with sufficient information to accurately determine GPIs, RPIs, and TCHs for ILS/PAR procedures. Since very few airfields will have ideal terrain conditions resulting in a smooth horizontal surface, including the approach surface base line (ASBL), runway, and glideslope antenna location, the runway "slope" or gradient must be considered. Slope may be defined as the amount a surface rises or falls in a given distance. Slope is expressed in feet/hundred feet and is negative if the threshold elevation is higher than that of the "RPI" and positive if the threshold elevation is lower. On engineering maps, slopes are sometimes expressed as a percentage. Prior to using this figure in calculations, it must be converted to a tangent. This is done by dividing the percentage figure by 100. Figure A6.1 shows negative and positive slopes and a means of determining them. See Figure A6.2 for computing an "Average Slope" when irregular or multiple slopes are involved.

Figure A6.1. Negative and Positive Slopes.



A6.1.1. The first procedure to be discussed will be an ILS. The physical location of the ILS glideslope antenna can influence the determination of these items:

A6.1.1.1. The Glide Path Angle.

A6.1.1.2. Threshold Crossing Height.

A6.1.1.3. Obstruction Clearance Criteria.

A6.1.1.4. Ground Point of Intercept.

A6.1.1.4.1. Several of the above items are interrelated, with each affecting the computation and limiting the permissible values which can be used. It's desirable to use optimum values for the critical items and then adjust other values within the required limits. The formulas in AFJMAN 11-226 should be used when determining TCH, GPI, and RPI for ILS. Determine if the runway slope constitutes rapidly dropping terrain by consulting the Engineering Installation personnel.

A6.1.2. The PAR RPI will be located at a point where an arc swung from the PAR antenna crosses the runway centerline (Figure A6.3.).

NOTE: PAR antenna and CLA reflector elevations relative to the elevation of the runway abeam their positions are not considered in PAR calculations. These elevations are compensated for by adjusting cursor voltages within the radar unit.

NOTE: RPI can be determined:

- At an existing site, the RPI may be determined from actual survey or calculations using rationale derived from paragraphs A6.1.1. or A6.1.2
- In selecting a new site, RPI is determined using the formula below given TCH, GS angle and runway slope.
  ø = Angle formed by glideslope and ASBL (glideslope angle) (Figure A6.4).

s = Runway slope.

a = Threshold elevation - RPI elevation.

d = Distance of RPI from runway threshold.

$$RPI = \frac{TCH}{\text{Tan } ø \, -(s)} \qquad RPI = \frac{TCH + (\text{Threshold Elev- Rwy Crown Elev Abeam Ref})}{\text{Tan } ø \text{ (GS)}}$$

After RPI has been established, GPI and TCH values may then be formed using the following method of calculation derived from available information:

$$TCH = (d \text{ Tan } ø) - (a) \qquad GPI = \frac{TCH}{\text{Tan } ø}$$

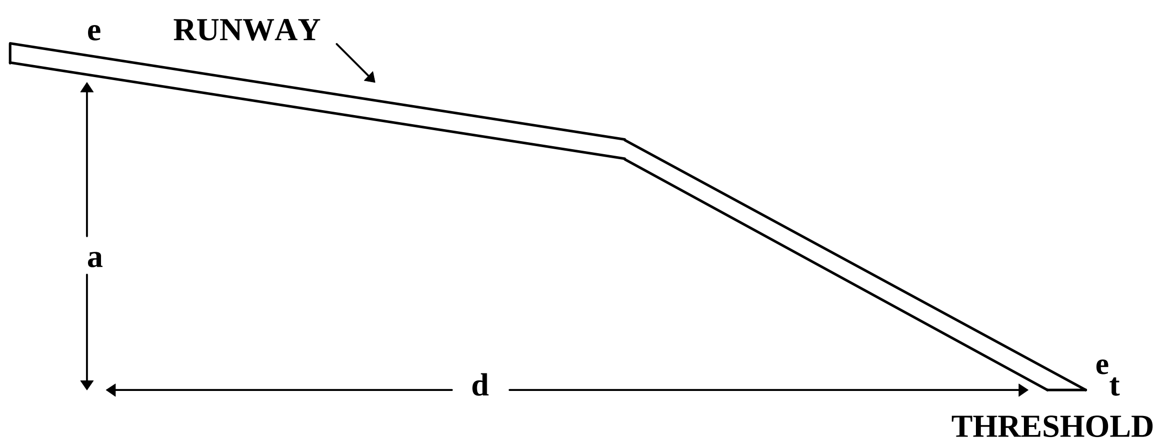
$$TCH = d (\text{Tan } ø - [s])$$

Figure A6.2. Average Slope Calculation.

Surfaces that have irregular or multiple slopes will require a calculation of the average slope (S) as expressed in the following method:

$$^{s}\text{avg} = \frac{e_t - e}{d}$$

d = Length of surface considered
e_t = Threshold elevation
e = Elevation at distance "d"
a = Rise

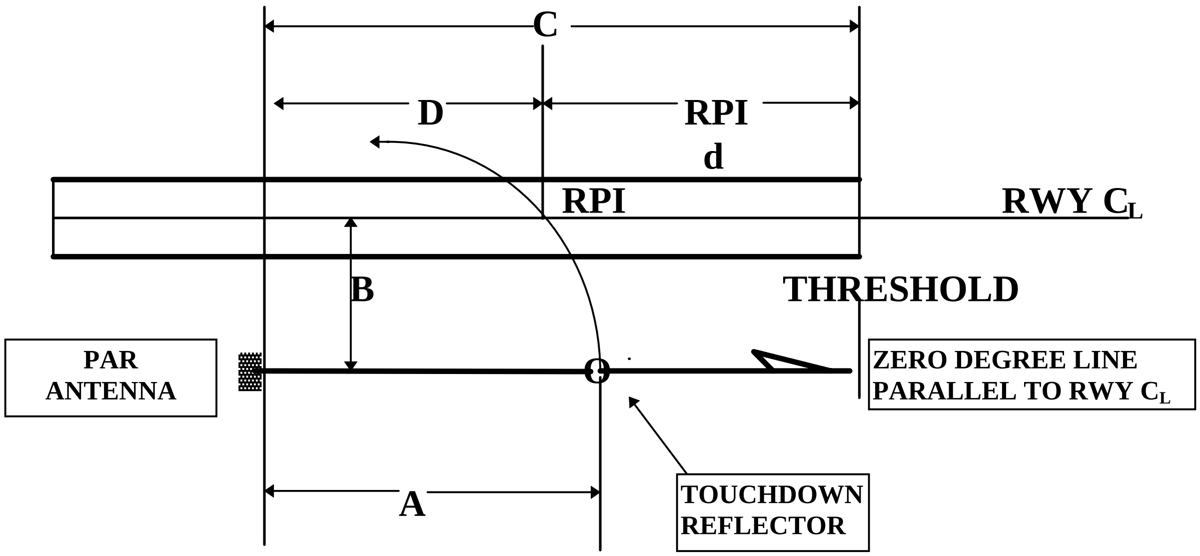


A6.2. Establishment of Minimum PAR/ILS Glide Path Angles. When developing or reviewing a precision instrument approach, determine the lowest usable glideslope (G/S) angle based on obstacle clearance. The amount of ROC for precision final approaches varies with the distance outward from the runway or GPI. As the aircraft gets closer to the signal source of the ILS or the PAR antenna, the more accurate the elevation guidance provided becomes; therefore, ROC is reduced as the aircraft gets closer to the runway. The final approach segment of any precision approach is divided into three separate zones, each with its own obstacle clearance surface. The following is a discussion of these surfaces and the methods used to determine them using a 2.5 degrees glideslope as an example.

Slope Ratios. Each glideslope angle has two associated obstacle clearance slope ratios. These are the inner and outer slopes underlying the glideslope. The inner slope is comprised of the first 10,975 feet of the glideslope and the outer slope is the remainder of the final approach area. The obstacle clearance surfaces do not have the same angle as the glideslope they are associated with; that is, a 2.5 degrees glideslope has a 50:1 inner slope and a 40:1 outer slope. These slope ratios would equate to a 1.150 and a 1.43 degrees angle, respectively. Also, these surfaces do not have the same points of origin as the glideslope. The combination of different points of origin and the angles account for the variable ROC. The term "slope ratio" is used to describe the rate at which a slope rises from the runway. It is expressed as x feet outward for each foot upward. As an example, a slope that rises one foot for each 50 feet outward is a 50:1 slope. The lower the first number, the steeper the slope; that is, a 34:1 slope is steeper than a 50:1 slope.

Zone One. This zone is the most critical phase of the approach; therefore, the surface to be protected is very restrictive. The Cat I ILS and PAR Zone One starts 200 feet outward from the landing threshold, but not less than 975 feet from GPI, and extends out to the DH point or the middle marker, as applicable, whichever is farther. This slope is part of the "inner" surface. The lateral dimensions are the same as the primary area of the final approach trapezoid and includes a 7:1 transitional surface. Obstacles in this area should be fully documented.

Figure A6.3. PAR RPI Distance from Runway Threshold.



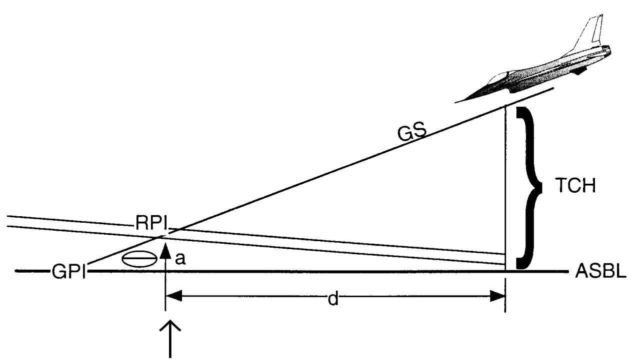
Given distances A, B, and C, the RPI distance from runway threshold may be calculated using the formulas below or the formula in AFJMAN 11-226, figure 129b:

A = Distance from PAR antenna to touchdown reflector.
B = Distance of PAR antenna from runway centerline.
C = Distance of PAR antenna from runway threshold.
D = Distance from where arc crosses runway.
d = RPI distance.

$$D = \sqrt{A^2 \quad B^2}$$

$$RPI(d) = C - D$$

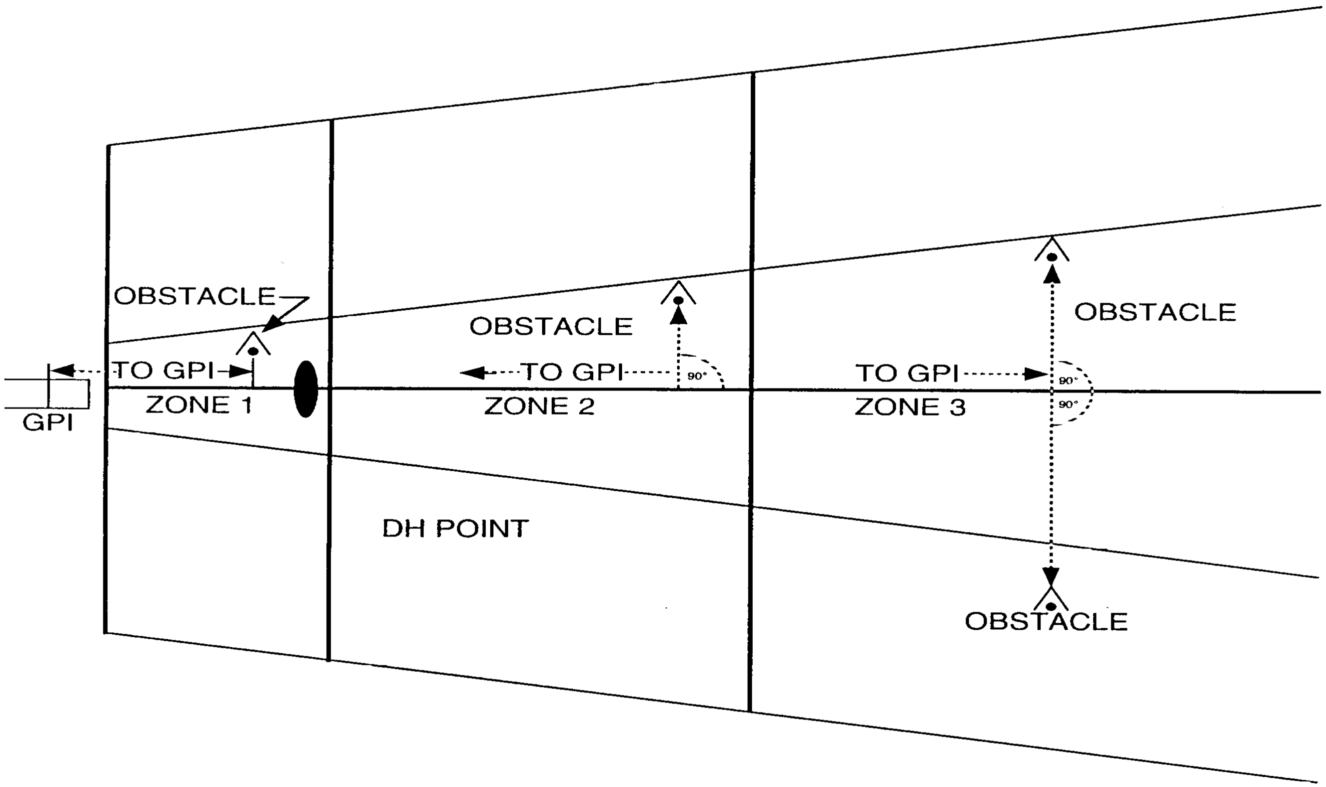
Figure A6.4. Formulas for Solving GPI, RPI, TCH.



"a" is distance between RPI & ASBL.

Zone Two. This slope originates at the MM or DH point, whichever is farthest from the landing threshold, and extends to a point 10,975 feet from GPI. Lateral dimensions are the same as the final approach trapezoid, including the 7:1 transitional areas. Zone two is part of the "inner" slope (figure A6.5).

Figure A6.5. Slope Ratios - Zone Two.



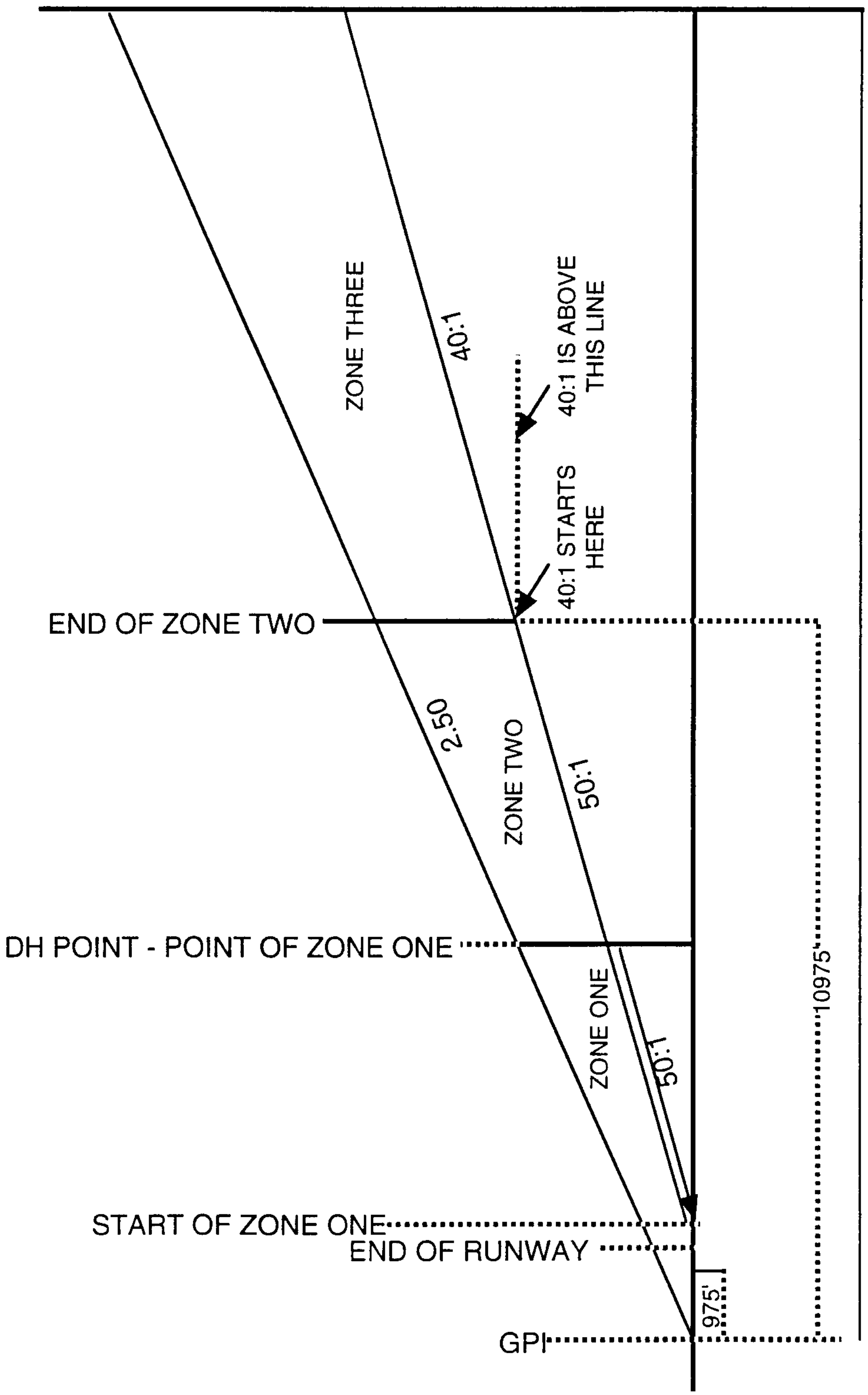
Zone Three. This zone starts 10,975 feet from GPI at the end of zone two and extends out to the glide path intercept point. The entire zone three is the outer slope ratio for any given glideslope angle. The slope starts at an altitude equal to the end of the zone two slope and rises at the applicable rate (figure A6.6) to the glide path intercept point or until 500 feet of ROC is achieved.

NOTE: 500 feet of ROC occurs at 22,776 feet from GPI, unless a higher ROC is required by precipitous terrain or other circumstances. 500 feet is the maximum ROC required in the intermediate or final approach segments.

Determining the Lowest Usable Glideslope Angle in Zone One. Take these steps:
Step 1. Measure the distance along the centerline between the start of zone one and the obstacle.
Step 2. Subtract the threshold elevation from the MSL height of the obstacle.
Step 3. Divide the distance in Step 1 by the answer in Step 2. This gives the slope ratio for the obstacle. Now refer to the table in attachment 2 and the applicable glideslope angle. If you are unable to accurately determine the angle from the graph, continue with the following steps to make a mathematical determination.
Step 4. Divide 10,000 by the slope ratio.
Step 5. Add 279.7935 to the answer in Step 4.
Step 6. Divide the answer in Step 5 by 10,975 to obtain the tangent of the angle associated with the slope ratio.
Step 7. Determine angle using tangent table or calculator.

Determining the lowest usable glideslope angle from zone 2 primary area.
Take these steps:
Step 1. Measure the distance along the centerline between GPI and the obstacle.
Step 2. Multiply the distance in Step 1 by .02366.
Step 3. Add 20 feet to the answer in Step 2.
Step 4. Subtract the threshold elevation from the MSL height of the obstacle.
Step 5. Add the results of Step 3 to Step 4.
Step 6. Divide the answer in Step 5 by the distance in Step 1. The answer is the tangent of the required glideslope angle.
Step 7. Determine angle by using tangent table or calculator.

Figure A6.6. Slope Ratios - Zone Three.



Determining the lowest glideslope angle in the zone three primary area. Take these steps:

Step 1. Measure the distance along the centerline between GPI and the obstacle.

Step 2. Multiply the distance in Step 1 by .01866.

Step 3. Add 75 feet to the answer in Step 2.

Step 4. Subtract the threshold elevation from the MSL height of the obstacle.

Step 5. Add the results of Step 3 to Step 4.
Step 6. Divide the answer in Step 5 by the distance in Step 1. The result is the tangent of the required glideslope angle.
Step 7. Determine angle by using tangent tables or calculator.

Determining the Lowest Usable Glideslope Angle in Transitional Areas. All three zones have 5,000 feet transitional areas on both sides of the primary area. These transitional surfaces start at the height of the obstacle clearance surface and rise at a 7:1 ratio in a direction that is 90 degrees to the centerline. Obstacles in the secondary (transitional) areas receive the same consideration in establishing a usable glideslope angle as obstacles in the primary area. To determine the lowest usable glideslope for an obstacle located in the transitional areas, continue as indicated.
Step 1. Draw a line 90 degrees to the centerline between the inside edge of the transitional area and the obstacle.
Step 2. Measure the distance, in feet, along the line.
Step 3. Divide the distance obtained in Step 2 by 7.
Step 4. Subtract the answer in Step 3 from the MSL height of the obstacle. The answer is the adjusted height of the obstacle. It may now be considered just as if it were in the primary area.
Step 5. Measure the distance along the centerline between the GPI and the obstacle.
Step 6. Multiply the distance in Step 1 by .02366 for zone 2 or .01866 for zone 3.
Step 7. Add 20 feet for zone 2 or 75 feet for zone 3 to the answer in Step 6.
Step 8. Subtract the threshold elevation from the answer in Step 4.
Step 9. Add the results of Step 8 to the answer in Step 7.
Step 10. Divide the answer in Step 9 by the distance in Step 5 to ascertain the tangent of the required glideslope angle.

A6.3. Selection of TACAN and VOR Final Approach Radials for on-Airport Facilities. Radials selected must meet specified lateral displacement limits relating to extended runway centerlines. The final approach course should be aligned to intersect the extended runway centerline at a point 3,000 feet from the threshold. If an operational advantage can be attained when the final approach course does not intersect the centerline, the course must lie within 500 feet laterally of the extended centerline at a point 3,000 feet outward from the runway threshold. As it is difficult to determine accurate crossover points from drawings, the following systems can be used to determine the crossover point, lateral displacement of a radial, or determination of the optimum radial. It is paramount to ensure that engineering maps accurately reflect the location of NAVAIDs. An engineering scale is needed to make accurate measurements.

Symbology terminology:
Angle a = The difference between the runway heading and final approach course stated in degrees.
T = Tangent of angle a.
D-1 = Lateral distance from a point on the runway centerline or extended centerline, stated in feet, obtained from survey results or engineering maps.
D-2 = Distance in feet from a point on the runway centerline opposite the facility to the crossover point, derived from calculations explained below.
D-3 = Distance from a point on the runway centerline opposite the facility to runway threshold. This is a negative value if the facility is located behind the threshold (figure A6.7) or a positive value if the facility is located in front of the runway threshold (figure A6.8). Obtain this measurement from actual survey or engineering map.
D-5 = The distance from the facility to a point 3,000 feet from the runway is obtained by adding distance D-3 to 3,000 feet when D-3 is a negative value or by subtracting D-3 from 3,000 feet when D-3 is a positive value.
D-6 = The lateral displacement distance at 3,000 feet between the extended runway centerline and the final approach radial obtained by the following mathematical calculations.

Finding approach radial/runway centerline crossover point. The approach facility behind the runway threshold (figure A6.7):
Step 1. Determine the distance between the facility and the runway center-line (D-1).
Step 2. Obtain the distance between the facility and the runway threshold (D-3).
Step 3. Determine the difference between the inbound heading of the extended runway centerline and the inbound heading of the final approach course radial (angle a).
Step 4. Convert angle a to a tangent.
Step 5. Divide distance D-1 by the tangent.

Finding lateral displacement of approach radial/runway centerline 3,000 feet from runway threshold:
Step 1. Divide distance D-1 by the tangent of the angle a.
Step 2. Add distance D-3 to 3,000 feet to get distance D-5.
Step 3. Subtract distance D-5 from distance D-2.
Step 4. Multiply the rest of Step 3 by the tangent of angle a. If the answer to Step 4 (distance D-6) is 500 feet or less, it meets lateral displacement criteria. If it exceeds 500 feet, consider selecting another radial or requesting a waiver.

Figure A6.7. Selecting Final Approach Radial (Facility Behind Threshold).

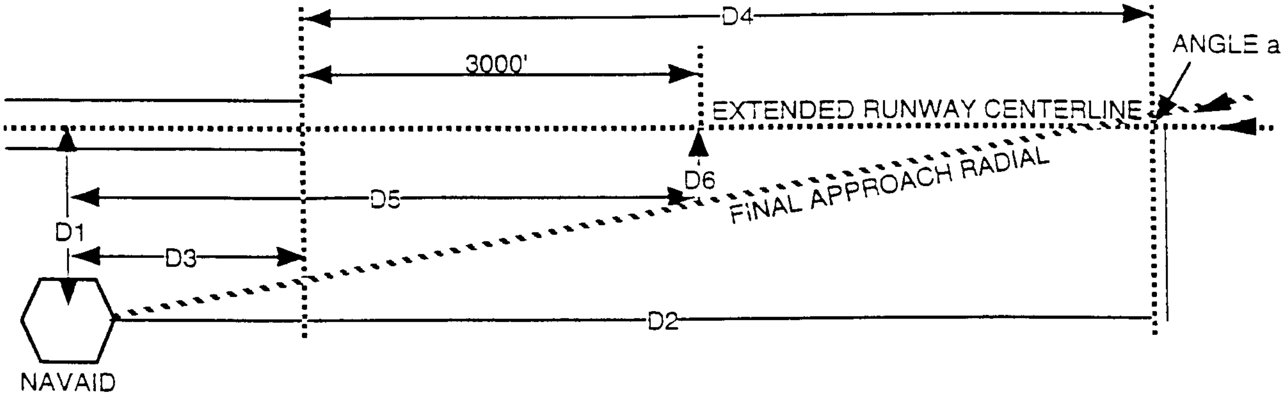
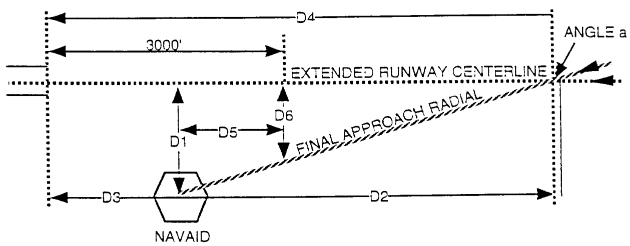


Figure A6.8. Selecting Final Approach Radial (Facility in Front of Threshold).



Selecting final approach radials. By using the following method, a final approach radial can be selected that meets the lateral displacement criteria:

Step 1. Subtract 500 feet from distance D-1 (figure A6.7).

Step 2. Divide the answer in Step 1 by distance D-5 to obtain the tangent of angle a.

Step 3. Convert the tangent of angle a to degrees. Always round up to the next highest whole number.

Step 4. If the flight path of the aircraft along the final approach course crosses the extended centerline from right to left as in figure A6.7, subtract the results in Step 3 from the runway heading. If the aircraft crosses from left to right , add the results in Step 3. If the facility is located in front of the runway threshold as in figure A6.8, subtract distance D-3 from 3,000 feet in Step 2. The remainder of the calculations are the same. Reducing the distance subtracted from distance D-1, in Step 1, the approach radial will move closer to the centerline at the 3,000 foot point. As an example, by subtracting 0 feet from D-1 in Step 1, a crossover point is established at 3,000 feet.

A6.4. General Obstacle Charting and Map Information. The procedure specialist should have extensive knowledge of existing and proposed obstacles in the areas used for the final approach, missed approach, and circling areas since these are the obstacles which will control the minima. Other segments of the approaches are more likely to be controlled by airspace and air traffic considerations than by obstacles. Trees on and near the airport must be evaluated for Obstacle Identification Surface (OIS) encroachment. The annual rate of tree growth must be considered and documented for future reference. A line of trees acceptable today may not be acceptable five or six years from now. Obstruction/Obstacle Conditions are in FAR, Part 77. AFJMAN 11-226 contains the obstruction clearance requirements for terminal approach procedures. Enroute procedures are in FAA Handbook 8260.19. The fundamental sources of obstacle information will be various charts, maps and engineering maps. There is no single chart/map that will provide all the information needed in designing instrument procedures. In the following discussion, a number of available sources of information will be mentioned. Charts and maps available through the National Imagery and Mapping Agency (NIMA) depict only those obstacles 200 feet or more above ground elevation. Contour intervals may vary from 2 feet to 2,000 feet, depending on the particular chart/map. Detailed descriptions and requisitioning procedures are in the *DoD Catalog of Aeronautical Charts and Flight Information Publications*. NIMA also publishes the *DoD Chart Updating Manual (CHUM).* The CHUM should be used to update obstruction information on published charts between publication dates. US Geological Survey maps may be requested through airfield management, using the appropriate format as required by their distribution system. Limited purchases may be made through local offices of the US Geological Survey in major cities. For units east of the Mississippi River, address requests for geological survey map indexes to:

Washington Distribution Section
US Geological Survey

1200 South Eads Street
Arlington VA 22202

For units west of the Mississippi River, including Alaska, Hawaii, Louisiana, American Samoa and Guam, use:

Denver Distribution Section
US Geological Survey
P.O. Box 25286
Federal Center
Denver CO 80225

These topographical maps are usually called "Quads" (quadrangle) and come in scales of 1:24,000, 1:62,500 and 1:250,000. These maps are especially useful for terrain information. On these maps, all terrain information is "bald" and height of trees is an additional consideration. Height of man-made obstacles is not shown, requiring the use of other sources to obtain information concerning them. Consider a visit to county/state engineers or a visit to planning and zoning commissions.

The following information is provided as an explanation of items to be found on available maps and charts. Not all maps and charts will provide the same information:

Geographic Coordinates. Indicated on all four corners of the maps.

Declination Diagram. Found in the lower margin. Indicates the direction of true north, magnetic north, and grid north; the angle between those directions in degrees and minutes; the date for which the diagram was compiled and the annual magnetic change.

Elevation, Contour Interval. The contour interval is indicated as well as the datum to which all elevations are referred.

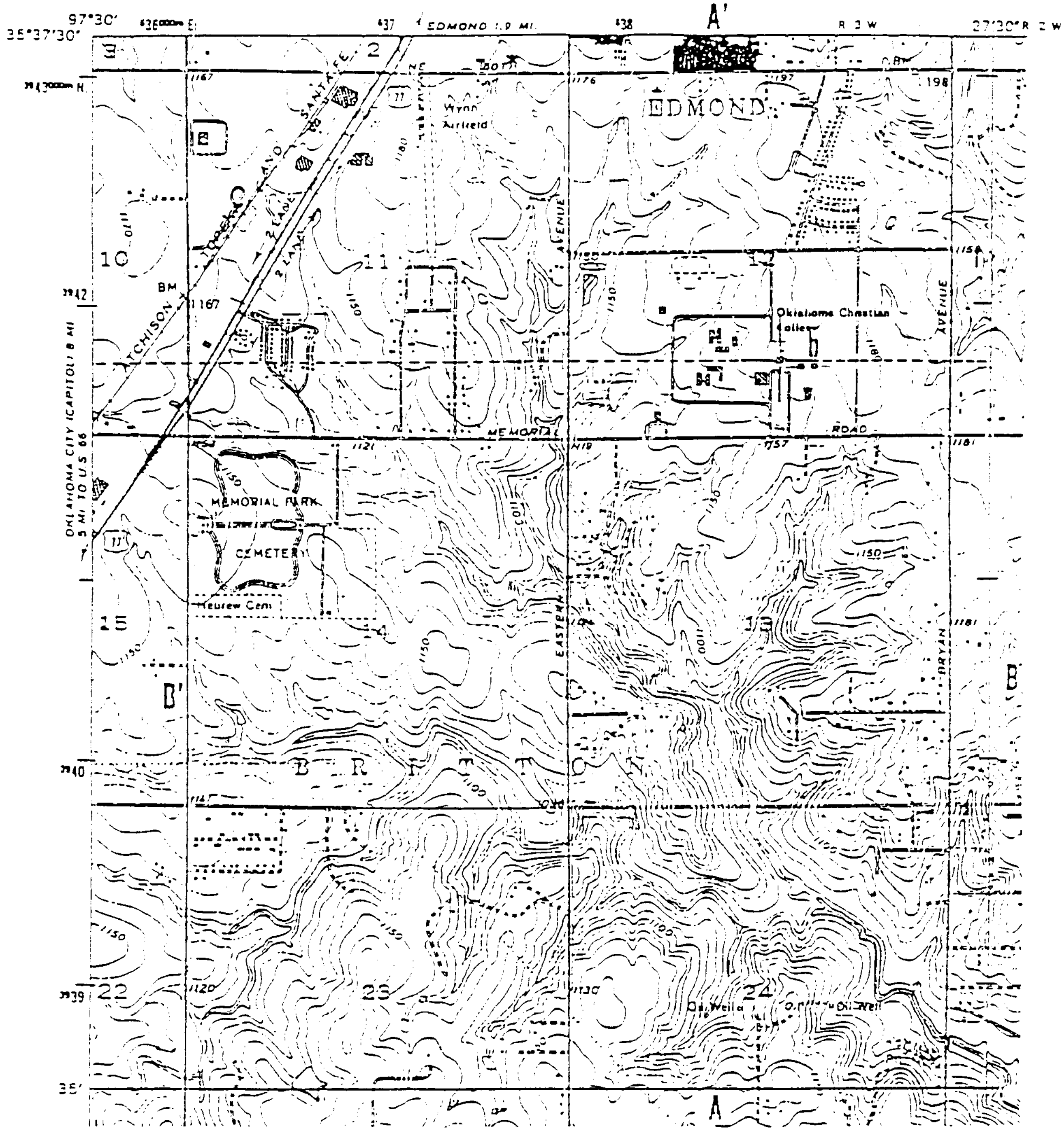
Latitude and Longitude Designation. The map borders are lines of latitude and longitude and, at each corner of the map, you will find the latitude and longitude of that corner in degrees, minutes and seconds. Two and one half, 5 minutes, etc., intersections are indicated on the face of the map in black crosses, with large tick marks along the border which show numbers indicating minutes and/or seconds.

A6.5. Determining Points on Maps and Charts. Since available maps generally do not portray the location of man-made obstacles or NAVAIDs, it becomes necessary to have a method of accomplishing this. The following provides a means of determining a point on the map when geographical coordinates are known, a way to find the geographical coordinates of a point, and a means to determine distances between two given geographical coordinates. Two different methods will be given to plot/locate coordinates. When using an engineer's scale to measure distances, the scale affording the greatest accuracy should be used. The scale selected must then be used throughout the operation.

METHOD 1--PLOTTING GEOGRAPHICAL COORDINATES

Step 1. Locate the 2 1/2, 5, 10 minute, etc., rectangle enclosing the coordinates to be plotted. Figure A6.9 depicts a 7.5 minute "Quad", although any map having the coordinates on it may be used.
Step 2. Convert the distance A to A' (prime) to seconds by subtracting the coordinates of one from the other after converting degrees and minutes to seconds, if necessary.
Example: A'- A coordinates = answer in seconds.
Step 3. Find the difference of the latitude of the point to be located (point b) to A and from the longitude of the point to be found (point b) to B and convert to seconds, if necessary.
Example: Point b latitude - A = answer in seconds.
Step 4. Calculate the ratios in seconds between the distances A to point b and A to A' and between B to point b and B to B':
Example: A to point b divided by A to A' = ratio. B to point b divided by B to B' = ratio.
Step 5. Use an engineer's scale to measure the total distance between A to A' and B to B'.
Example: A to A' = 45.6 B to B' = 31.2
Step 6. Multiply the measured distance A to A' and B to B' times the ratios obtained in Step 4. This will provide the distances A to point b and B to point b expressed in the same scale used when measuring the distance to calculate the ratios.
Step 7. Using the engineer's scale, measure the distance from A to point b along B and B' up from A, connecting the points with a light line.
Step 8. Using the engineer's scale, measure the distance to point b along the line drawn in the previous step. Where the lines intersect is the desired point.

Figure A6.9. Locating Geographical Coordinates



Determining Distance Between Two Given Geographical Coordinates. Convert the latitude and longitude degrees, minutes and seconds to a value expressed as degrees and a decimal using these coordinates:

1. $X_1 = 34^0$ 44’ 18.0438" N $Y_1 = 120^0$ 35’ 03.9505" W

$X_2 = 34^0$ 43’ 20.6078" N $Y_2 = 120^0$ 33’ 58.0098" W

X_1, X_2 = Latitude coordinates converted to degrees and a decimal.

Find the differences between X_1 and X_2 :

$X_1 = 34^0$ 44’ 18.0438" N = 34.7385 N

$X_2 = 34^0$ 43’ 20.6078" N = <u>34.72239</u> N

.01611 degrees

2. Y_1, Y_2 = Longitude coordinates converted to degrees and a decimal.

Find the differences between Y_1 and Y_2.

$Y_1 = 120^0$ 35’ 03.9505" W = 120.58443 W

$Y_2 = 120^0$ 33’ 58.0098" W = <u>120.56611</u> W

.01832 degrees

3. Divide the difference of the latitude (step 1) by 2 and add the result to the lower latitude value to find the Midpoint Latitude (MPL):

.01611 divided by 2 + 34.72239 degrees = 34.73045 degrees

4. Use the MPL found in step 3 in the following to determine the length of a second of latitude in feet (L_1)

L_1 = 60.00653 - (.30564 cos (2 MPL)) + (.00065 cos (4 MPL)(6076.11549)) divided by 3600 = 101.0978 feet.

5. Use the MPL from step 3 in the following formula to find the number of feet in a second of longitude:

L_2 = 60.15936 cos(MPL) - (.05105 cos (3 MPL)) + (.00006 cos (5 MPL)) 6076.11549 divided by 3600 = 83.46888 feet.

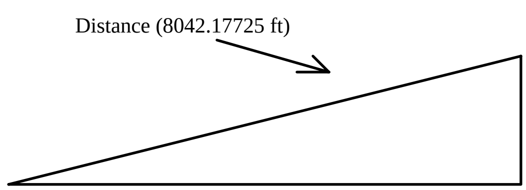
6. Use the formula in Figure A6.10 to find the distance between the original sets of coordinates:

Figure A6.10. Computing Geographical Coordinates.

Distance = the square root of $((x_1 - x_2)\ 3600\ L_1)^2 + ((Y_1 - Y_2)\ 3600\ L_2)^2$ = 8042.17725 feet.

Latitude X_2 = 34.72239 degrees N

Longitude Y_2 = 120.56611 degrees W



Latitude X_1=34.73835° N

Longitude Y_1= 120.58443 degrees W

NOTE: A word of caution; there will be some differences because of the mathematics used for computations in various parts of the world, but this will be reasonably close.

To Find Geographical Coordinates-Method 1

Step 1. Locate the 2 1/2, 5, 10 minute, etc., rectangle containing the coordinates to be located (figure A6.11).

Step 2. Using the engineer's scale, measure distances A to A' and B to B'.

Example: A to A' = 45.6 B to B' = 31.2

Step 3. Using the engineer's scale, measure distances A to b and B to point b. (Ensure that the distance is measured perpendicular to the coordinate line of the rectangle.)

Example: A to point b = 41.2
B to point b = 9.2

Step 4. Calculate the ratios between A to point b and A to A' and between B to point b and B to B'.

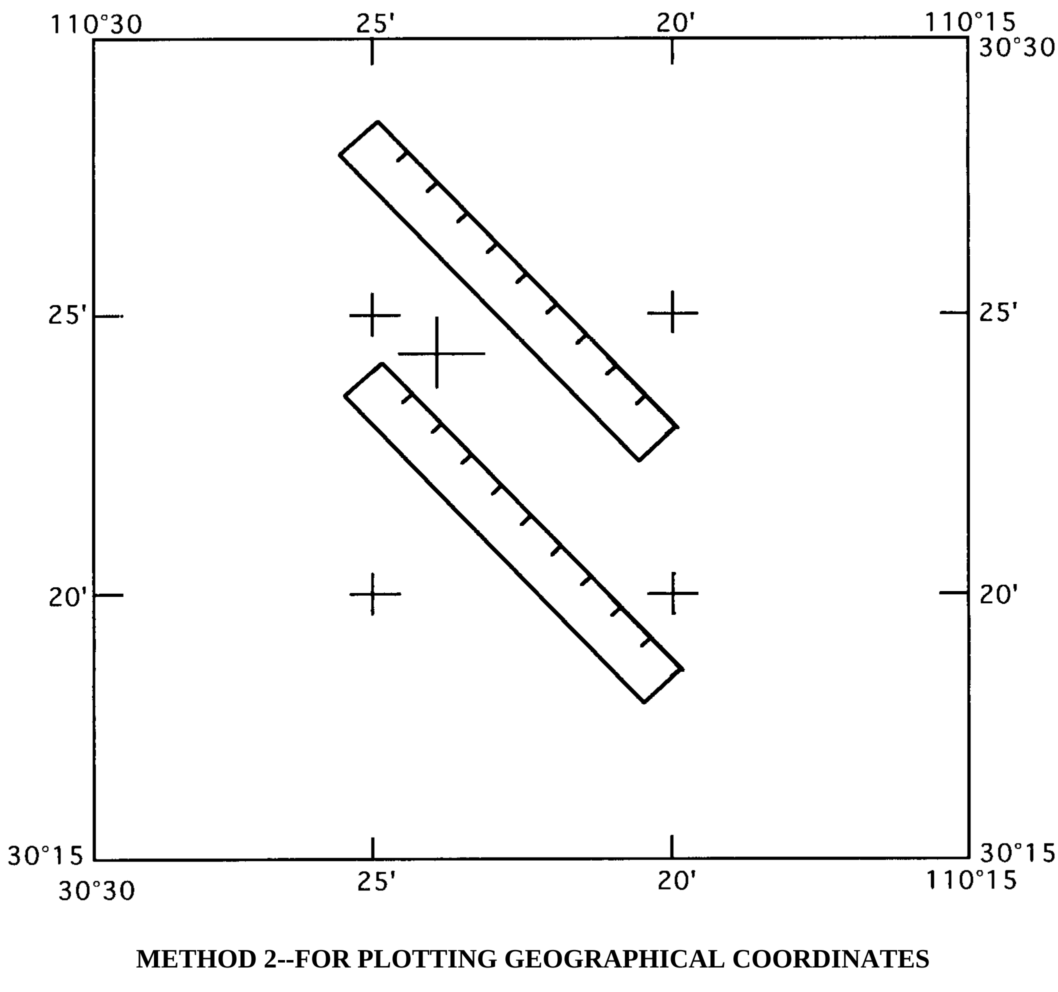
Example: A to point b divided by A to A' = ratio
B to point b divided by B to B' = ratio

Step 5. Convert the distances between A' to A and B to B' times the ratios obtained in step 4 to find the differences A to point b and B to point b expressed in seconds.

Step 6. Multiply the differences in seconds A to A' and B to B' times the ratios obtained in step 4 to find the differences A to point b and B to point b expressed in seconds.

Step 7. Add the number of seconds difference between A and b to the value of A. Add the number of seconds difference between B and b to the value of B. The results will be geographical coordinates of point b, after the seconds have been converted to minutes and degrees, if necessary.

Figure A6.11. Plotting Geographical Coordinates.



METHOD 2--FOR PLOTTING GEOGRAPHICAL COORDINATES

1. Locate the latitude/longitude tick marks on the chart to be used. The marks, when connecting lines are drawn, will define rectangles. Select the rectangle which encloses the point for which the exact coordinates are to be found. If the chart selected has the latitude/longitude lines drawn out (ONC series, etc.), care must be exercised in determining the proper rectangle since there will be so many lines which could be confused with the lines desired. This step is extremely important (figure A6.11).

2. Select a scale on an engineer's rule based on the accuracy required. Since an engineer's scale is divided into parts per inch, greater accuracy will result if a high scale is selected (that is, 60 parts/inch Vs 30 parts/inch). This scale must be used throughout the remainder of this procedure.
3. Using the scale selected above, measure the longest side of the latitude/longitude rectangle located in step 1. Select a number that is as long or longer than the longest side measured. (Example: Using the 1" = 60 parts scale, if the longest side of the rectangle is 457 parts, then select 500 parts). This random number selection does not affect accuracy.
4. Determine the number of seconds in one side of the latitude/longitude rectangle from Step 1. Divide this number by the number of parts determined by Step 3. Example:

Map scale 1" = 24,000" in 7.5 minute Quad.
Latitude/longitude rectangle = 2' 30" = 150 seconds.
Number from Step 3 = 500
150 divided by 500 = .3 (factor)

This factor is fractions of a degree. It will be used to convert the number of parts per inch to be measured in Step 6 back to degrees.
5. Place the zero end of the scale selected in Step 2 on the lower degree latitude/longitude line and the number selected in Step 3 on the higher degree latitude/longitude line bounding the rectangle. The engineer's scale will be tilted at an angle; however, this is of no concern since accuracy is not affected. Slide the engineering scale along the latitude/longitude lines until the scale selected in Step 2 is over the point for which the coordinates are desired.
6. Determine the number of parts to the point located in Step 5. Multiply this number by the factor found in Step 4 to find the number of seconds. Convert this number to minutes and seconds (60 seconds = +1 minute).
7. Add the result in Step 6 to the lower degree side bounding the rectangle to determine the latitude/longitude coordinate of the desired point.
8. The same steps are used to find either latitude or longitude, the only difference being the direction the scale is moved. The factor and the parts per inch initially selected must remain the same in both processes.
9. By selecting a scale (such as 1" = 50 parts per inch) when using a 1:62,500 map, the number of seconds can be read directly when the number 30 (0) is used between the two 5-minute parallels. There are 300 seconds between the two parallels and 30 subdivisions on the engineer's scale.

Finding a Point Whose Geographical Coordinate is Given-Method 2 (Figure A6.11):

1. Follow Steps 1, 2, 3 and 4 as outlined in the previous procedure:

Scale Selected
Number Selected
Factor

2. Determine the number of seconds from the point to be located to the lower value latitude/longitude.

Example:

35 25 13N	101 33 11W
-35 25 00N	-101 30 00W
13"	3'11" = 191"

Multiply the number of seconds by the factor from the previous step.
3. The number from Step 2 will be parts per inch to be used on the engineer's scale to locate the desired latitude/longitude coordinate.
4. Place the zero end of the scale selected on the lower degree latitude/longitude line. Locate a point using the parts per inch derived in Step 2 in the approximate position of the desired coordinate.
5. Using the same parts per inch number in Step 4, locate another point a short distance from the initial point selected. Draw a pencil line between the two points.
6. Repeat Steps 4 and 5, using the same process, to find the position of the other coordinate.
7. The point where the lines intersect is the location of the other coordinate.
8. By selecting a scale (such as 1" = 50 parts per inch) when using a 1:62,500 scale map, the number of seconds may be read directly from the scale when the number 30 (0) is used since there are 300 parts on the engineer's scale and 300 seconds between the two 5-minute parallels.

A6.6. Obstruction Evaluations. Federal Aviation Regulation (FAR) Part 77 requires that notification be provided to the FAA on proposed construction or alteration of structures which might present a hazard to flight. FAA Form 7460-1, Notice of Proposed Construction or Alteration, is the medium for that notification of construction or alteration.

A6.6.1. Responsibility and Processing of FAA Form 7460-1. The appropriate FAA region has the responsibility to process all FAA Forms 7460-1 in accordance with FAR Part 77 and FAAO 7400.2, Procedures for Handling Airspace Matters. The FAA Region Air Force Representative (AFREP) will forward the FAA Form 7460-1 to the affected military installation for evaluation and recommendations.

A6.6.2. Review of notices. When reviewing the FAA Form 7460-1, the TERPS Specialist should evaluate the following:
A6.6.2.1. Effect on VFR Traffic. This is done by the FAA Obstruction Evaluation (OE) Specialist at the FAA Region by applying FAR Part 77 Military Surfaces criteria. However, the Unit TERPS Specialist should also evaluate for effect on VFR traffic that may be unique to his/her base's operating procedures. Consider effect on VFR routes, unique airport/terminal operations, or other known concentrations of VFR traffic. NOTE: Base Operations should have received a copy of the proposed construction/alteration to determine if there is affect on the VFR traffic patterns. TERPS Specialists should check with Base Ops to ensure they have received the proposal.
A6.6.2.2. Terminal Area IFR Operations. The effect upon terminal area IFR operations; e.g., transitions, radar vectoring (MVAC), Minimum IFR altitudes, holding, STARs, and SIDs,
A6.6.2.3. Instrument Approach/Departure Procedures. The effect upon any segment of an Instrument Approach Procedure (IAP). Also, the effect upon any proposed IAP or any departure restriction.
A6.6.2.4. Adjustments to Instrument Flight Procedures. If it is determined the structure will have an effect on an instrument flight procedure, it should be stated what adjustments can be made without adversely affecting the procedure. The TERPS Specialist shall not amend an IAP until receipt of the FAA Form 7460-2, Notice of Actual Construction or Alteration, or other notification relative to an obstacle which will have a procedural affect. If during procedural review or while on a site visit, it becomes obvious for safety reasons that the existence of a previously unknown obstacle requires procedure minima to be raised, expedite accomplishment of the change by means of a NOTAM.
A6.6.2.5. Recommendations. If the proposed construction or alteration will have an adverse effect on VFR or IFR aircraft operations, procedures, or minimum IFR altitudes, the response back to the FAA Region AFREP should clearly state the extent of these affects and if possible, provide an acceptable solution (i.e., If the proposed antenna is reduced by XX feet, there would be no adverse affect to IAPs or SIDs). The adverse affect should also be brought to the attention of Wing Flying officials (DO, Stan Eval, etc.). File all proposals within an obstruction data file. The rational being that construction could be delayed for various reasons and the same proposal may resurface one or two years later.

A6.7. Quick References, TERPS. The formulas in this section will provide the most commonly needed methods of computations. Carry out mathematical calculations only to the number of decimal places supplied by the figures used. Tangents used should not be rounded up. Do not round off results of computations (Figures A6-12 and A6-13).

Primary and Secondary Areas of Nonprecision Final Segments:
ROC_s = Required Obstacle Clearance in Secondary Area.
ROC_p = Required Obstacle Clearance in Primary Area.
W_s = Width of secondary (nm) (also at obstacle point).
Wp = Width of primary (nm).
W_{sf} = Width of secondary at the FAF (nm).
W_{pf} = Width of primary at the FAF (nm).
D = Distance to be considered (nm) (from FAF, MAP, etc.).
L_I = Length of intermediate segment (nm).
W_s = MAP = Width of the secondary at the missed approach point (nm).
W = Width.
d = Distance of obstacle from primary area.

a. On airport VOR/ no FAF:
$W_s = .134D$ $1/2\ W_p = .2D + 1nm$

b. VOR/TACAN with FAF:
$W_s = .0333D$ $1/2\ W_p = .05D + 1nm$

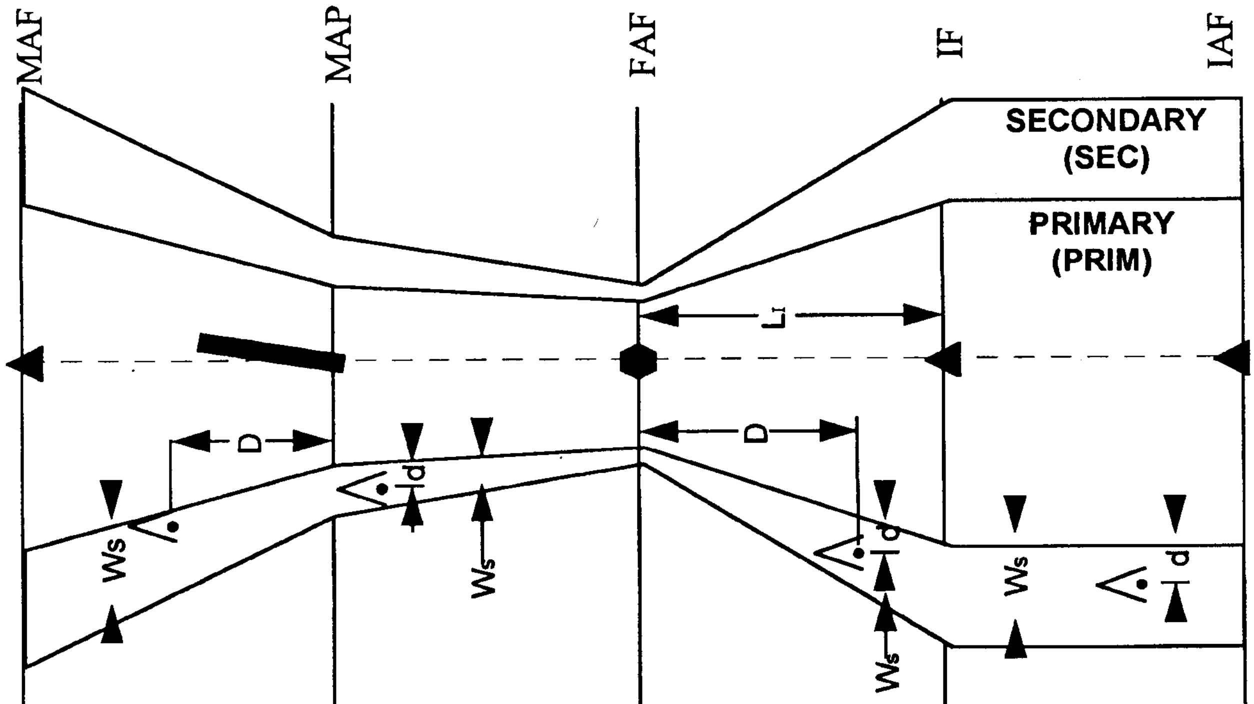
c. On airport NDB/no FAF
$W_s = .134D$ $1/2\ W_p = .175D + 1.25$ nm

d. NDB with FAF:
$W_s = .0666D$ $1/2\ W_p = .0833D + 1.25$ nm

e. ASR:
$1/2\ W_p = .1D + 1nm$ (no secondary)

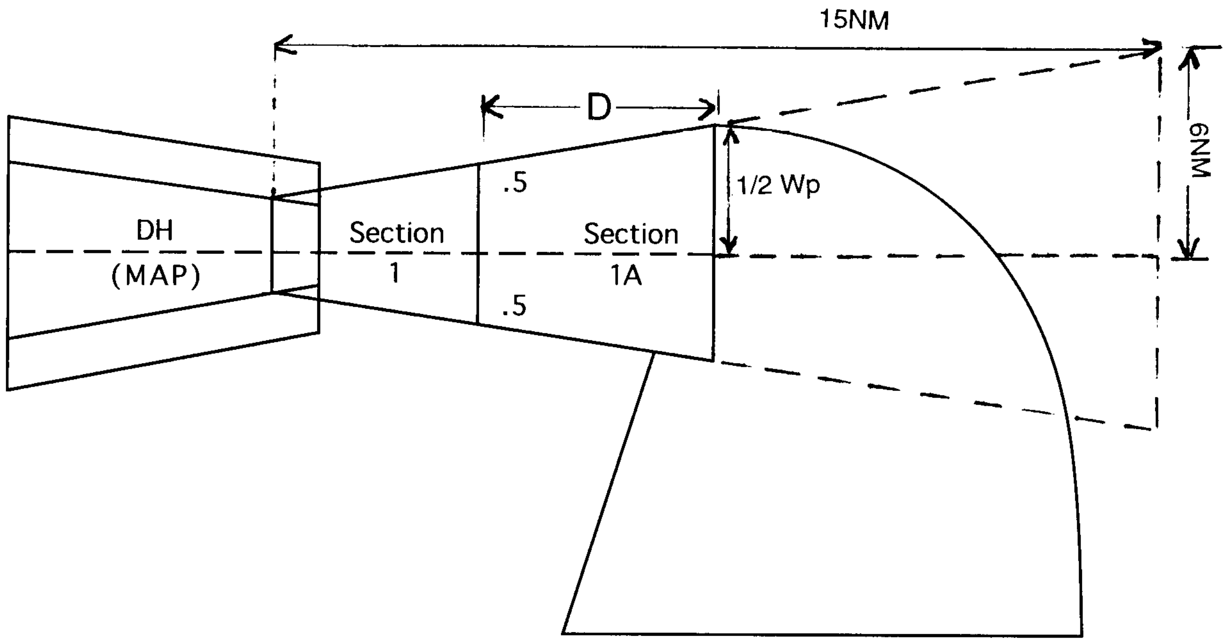
Figure A6.12. Instrument Approach Procedures TERPS Formulas.

NON-PRECISION



MISSED APPROACH		FINAL SEGMENT		INTERMEDIATE SEGMENT		INITIAL SEGMENT	
PRIM	SEC	PRIM	SEC	PRIM	SEC	PRIM	SEC
40:1	12:1	VARIABLE		500'	500' TO 0'	1000'	500' TO 0'
$1/2W_p = \frac{4 - 1/2W_{pmap}}{15} \times D + 1/2W_{pmap}$ $W_s = \frac{2 - W_{smap}}{15} \times D + W_{smap}$ The subscript 'pmap or smap' refers to the segment width @ the MAP.		W_s = Formula from appropriate chapter $ROC_s = \frac{W_s - d}{W_s} \times ROC_p$		$1/2W_p = \frac{4 - 1/2W_{pf}}{L_I} \times D + 1/2W_{pf}$ $ROC_s = \frac{W_s - d}{W_s} \times 500$ $W_s = \frac{2 - W_{SF}}{L_I} \times D + W_{SF}$ The subscript 'SF or PF' refers to the segment width @ the FAF.		W_s = CONSTANT (2NM) $ROC_s = \frac{W_s - d}{W_s} \times 500$ The above formula also applies to holding.	

Figure A6.13. TERPS Formulas: Missed Approach Combination Straight and Turning Length of Section 1A.



Section 1A Combination Straight Ahead and Turn is considered from the beginning of Section 1A. To compute 1/2 wp at end of Section 1A, use the following formula:

1/2 Wp = .407407 X D + .5

PRECISION APPROACH FORMULAS (ILS/PAR)

a. Width of segment. ILS, PAR: 1/2 W = 500 + .15D

b. Minimum ROC in feet for any given distance ("D") from GPI:

ILS/PAR

"D" less than 10,975’: ROC = .02366D + 20’

"D" 10,975’ or more : ROC = .01866D + 75’

c. To determine lowest usable glideslope angle, see section B.

d. Tangent Formulas:

O = Height above threshold elevation.

A = Distance to a point from GPI along the centerline.

T = Tangent of selected glideslope angle.

$O = A \times T \qquad A = \frac{O}{T} \qquad T = \frac{O}{A}$

A6.8. Determining Lengths of Seconds of Longitudes.

Degrees Latitude	Factor
0-5	.00128
5-10	.00510
10-15	.00635
15-20	.00882
20-25	.01123
25-30	.01356
30-35	.01579
35-40	.01791
40-45	.01989
45-50	.02172
50-55	.02340
55-60	.02489
60-65	.02620
65-70	.02731
70-75	.02821
75-80	.02889
80-85	.02934
85-89.99	.02952

EXAMPLE: To find the length of a second of longitude at 45° 30’ 15" N, find 71.859 feet opposite 45° in table. Use the factor .02172 found opposite 45°-50°. Multiply the factor times the number of minutes/fractions of minutes(.02172 x 30.25’ = .65703 feet). Subtract .65703 feet from 71.859 feet of the length of a second of longitude at 45° 30’ 15"N.
Answer = 71.202 feet

Note: These factors are an average between the sets of degrees. If greater accuracy is needed, the following formula may be used.
1°long(nm) = 60.15936 x cos lat -[.05105 cos(3 x lat)] + [.00006 cos(5 x lat)]
1°lat(nm) = 60.00653 - [.30564 x cos(2 x lat)] + [.00065 cos(4 x lat)]

NOTE: All latitudes in degrees with minutes and seconds expressed as a decimal 45.05432°

LENGTH OF A SECOND OF LONGITUDE

LAT°	FEET PER " OF LONG	LAT°	FEET PER " OF LONG	LAT°	FEET PER " LONG
0	101.452	31	87.039	61	49.312
1	101.436	32	86.118	62	47.755
2	101.390	33	85.170	63	46.182
3	101.313	34	84.196	64	44.595
4	101.206	35	83.197	65	42.995
5	101.068	36	82.172	66	41.381
6	100.899	37	81.122	67	39.754
7	100.700	38	80.048	68	38.115
8	100.471	39	78.949	69	36.465
9	100.211	40	77.825	70	34.803
10	99.920	41	76.678	71	33.130
11	99.600	42	75.508	72	31.447
12	99.249	43	74.314	73	29.754
13	98.868	44	73.098	74	28.053
14	98.457	45	71.859	75	26.342
15	98.017	46	70.598	76	24.623
16	97.547	47	69.315	77	22.895
17	97.047	48	68.012	78	21.163
18	96.517	49	66.687	79	19.423
19	95.959	50	65.342	80	17.676
20	95.371	51	63.976	81	15.926
21	94.754	52	62.591	82	14.169
22	94.109	53	61.187	83	12.408
23	93.435	54	59.764	84	10.643
24	92.733	55	58.323	85	8.875
25	92.002	56	56.863	86	7.104
26	91.243	57	55.386	87	5.331
27	90.457	58	53.892	88	3.553
28	89.643	59	52.382	89	1.781
29	88.802	60	50.855	90	0.000
30	87.934				

A6.9. ILS/PAR Glideslope Angles Vs Final Approach Obstacle Clearance Surfaces. The following table can be used as a quick reference to ascertain ILS or PAR glideslope angles Vs final approach obstacle clearance surfaces:

GS°	X:1	X°	Y:1	Y°
2.50	50.1	1.14	40.0	1.43
2.55	47.8	1.20	38.6	1.48
2.60	45.7	1.25	37.4	1.53
2.65	43.8	1.31	36.2	1.58
2.70	42.0	1.36	35.1	1.63
2.75	40.4	1.42	34.0	1.68
2.80	38.9	1.47	33.1	1.73
2.85	37.5	1.53	32.1	1.78
2.90	36.2	1.58	31.3	1.83
2.95	35.0	1.64	30.4	1.88
3.00	33.8	1.69	29.6	1.93
3.05	32.8	1.75	28.9	1.98
3.10	31.8	1.80	28.2	2.03
3.15	30.8	1.86	27.5	2.08
3.20	29.9	1.91	26.8	2.13
3.25	29.1	1.97	26.2	2.18
3.30	28.3	2.02	25.6	2.23
3.35	27.6	2.08	25.1	2.28
3.40	26.9	2.13	24.5	2.33
3.45	25.2	2.19	24.0	2.38
3.50	25.5	2.24	23.5	2.43

GS° = Glideslope Angle
X:1 = Slope Ratio of Inner Surface X° = Angle of Inner Slope Y:1 = Slope Ratio of Outer Section Y° = Angle of Outer Section

A6.10. True Bearing Conversions. TRUE BEARINGS shown on engineering maps are usually between 000 and 090, by quadrant. These bearings must be converted to TRUE AZIMUTH (relative to true north) for TERPS application. Using the illustration (Figure A6.14.), convert TRUE BEARING to TRUE AZIMUTH as follows:

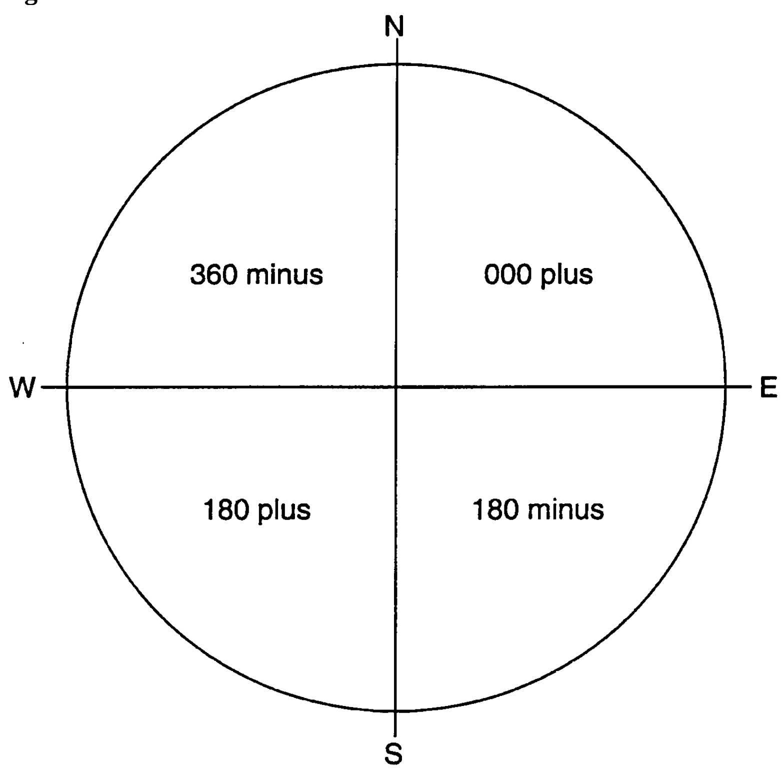
N45E - N and E identify the quadrant; therefore,
000 plus 045 equals 045° true azimuth
S45E - 180 minus 045 equals 135°
S45W - 180 plus 045 equals 225°
N45W - 360 minus 045 equals 315°

To find the magnetic heading (or Course) of the runway, the magnetic variation (VAR) must be added or subtracted from the true azimuth (or Course).

Example:

TC	-EAST +WEST VAR	= MC
060°	-10° E	= 050°
MC	+EAST -WEST VAR	= TC
050°	+10° E	= 060°

Figure A6.14. True Bearing Conversions.



A6.11.- Miscellaneous Formulas.
1nm = 6076.11548 feet
1sm = 5280 feet
1" Lat = 101.268594 feet (average)
1nm = 1.852 kilometers
1 km = 3280.839895 feet
1 meter = 39.3700787 inches

TO FIND	MULTIPLY	BY
Feet	Meters	3.2808399
Yards	Meters	1.093613298
Miles(sm)	Kilometers	0.6213711922
Meters	Feet	0.3048
Meters	Yards	0.9144
Kilometers	Miles(SM)	1.609344
Kilometers	Miles(NM)	1.85
Miles(sm)	Feet	.0001893939
Nautical Miles	Miles(sm)	.868976242
Nautical Miles	Feet	.000164579

Earth Curvature = Distance $(NM)^2$ x .88302
Distance $(SM)^2$ x .66679
Distance $(KM)^2$ x .25745

FAF to MAP Calculations - $\frac{\text{Dist(nm)} \times 60}{\text{Speed in knots}}$ = Time in minutes

Rate of Descent FPM = Ground Speed Knots x $\frac{\text{(G/S angle)}}{(57.29577951)}$ x 101.2685914

Missed Approach Surface:
Distance of obstacle in nm x 152'/nm = rise of surface to obstacle in feet.
$\frac{\text{Distance in feet}}{40}$ = rise of surface to obstacle

To find the length or angle of an arc: (See figure A6.15)

$$\text{Length} = \frac{\text{angle} \times \text{radius}}{57.29577951}$$

$$\text{Angle} = \frac{57.29577951 \times \text{length}}{\text{radius}}$$

The following formula may be used when it becomes necessary to calculate the straight-line distance between two points on an arc:

$$\text{Chord(C)} = 2\ R \sin \frac{(a)}{2}$$

Angle(a) = Number of degrees between Radials
Radius R = Distance (DME) of arc

$$\text{Degrees in decimals} = \frac{\frac{\text{seconds}}{60} + \text{minutes} = \text{Degrees}}{60}$$

A6.12. Cartesian Coordinates (X-Y axes). The position of an obstacle or facility can be located by determining its location by referencing it to the threshold of a runway. Use an engineer's scale and the proper measurement scale from the map to find the coordinate (Figure A6.16.).

Figure A6.15. Straight-Line Distance Between Two Points of an Arc.

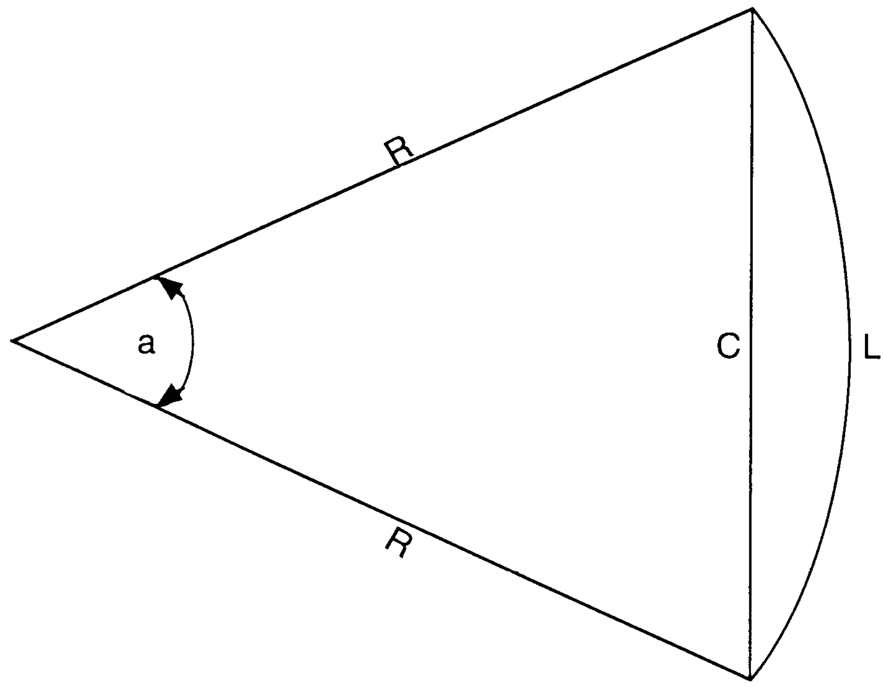
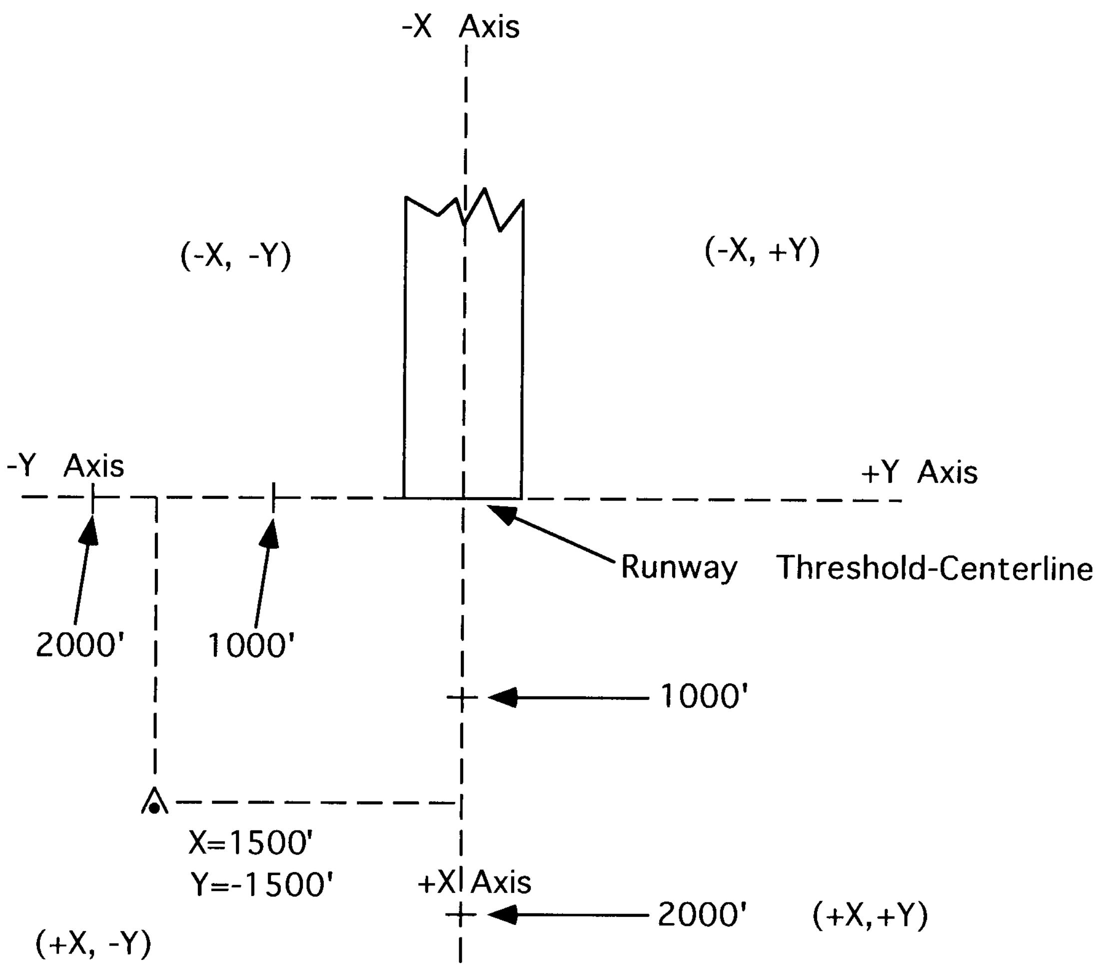


Figure A6.16. Cartesian Coordinates



CHECKLIST FOR REVIEW OF HOST NATION AIPs

A7.1. Is the candidate an ICAO member nation?

A7.2. If the AIP is for more than one country, are the candidate's methods and practices clearly discernible?

A7.3. If military procedures are involved, does the AIP specify methods and practices employed by the military authorities?
NOTE: Each country's military and civilian "TERPS" process must be evaluated separately if different methods are used to develop instrument procedures.

A7.4. Is the criteria utilized for the design of instrument procedures U.S. TERPS, ICAO PAN-OPS, or NATO APATC-1?

A7.5. Is flight inspection performed to international standards, for example ICAO Annex 10 or FAAH 8200.1?

A7.6. Have host declared exceptions to criteria and rules been evaluated and forwarded through channels to AFFSA/XOIP for approval?

A7.7. Does the TERPS office have an open line of communication with the host nation instrument procedure/aviation data OPR(s) to ensure AIP currency and maintainability?

A7.8. Does the TERPS office receive host NOTAMs? Timeliness is critical.

A7.9. Is the TERPS staff capable of sending NOTAMs?

A7.10. Have any sources (NIMA, USDAO, FAA, USAASA, NAVFIG, other USAF organizations, etc.) provided any specifics which undermine confidence in the host's products, methods, or practices?
NOTE: Failure of any of the "Confidence" checks will require a complete TERPS evaluation using US standards as specified in paragraph 2.6.6.2.3, and possible waiver actions.

CHECKLIST FOR REVIEW OF HOST NATION INSTRUMENT PROCEDURES

MSA
NAVAID/SOURCE

HOLDING PATTERNS
LEG LENGTH
NO COURSE SIGNAL ZONE

INITIAL SEGMENT
ARC/SEGMENT LENGTH
DESCENT GRADIENT
COURSE ALIGNMENT
FIX IDENTIFICATION
ALTITUDES
SPECIAL NOTES
LEAD RADIAL
TEARDROP ANGLE OF DIVERGENCE

INTERMEDIATE SEGMENT
SEGMENT LENGTH
DESCENT GRADIENT
COURSE ALIGNMENT
TURN ON HEADINGS
LEAD RADIAL
FIX IDENTIFICATION
ALTITUDES
SPECIAL NOTES

FINAL SEGMENT
SEGMENT LENGTH
DESCENT GRADIENT
COURSE ALIGNMENT
TURN ON HEADINGS
STEPDOWN FIXE(S)
FIX IDENTIFICATION
ALTITUDES
THRESHOLD CROSSING HEIGHT
SPECIAL NOTES

MISSED APPROACH SEGMENT
COURSE ALIGNMENT
ALTITUDE CLIMB GRADIENTS
SPECIAL NOTES
REVIEW WORDING OF MISSED APPROACH INSTRUCTIONS

PLAN VIEW
SPECIAL NOTES
RESTRICTIONS
LEGIBILITY

PROFILE VIEW
SPECIAL NOTES
RESTRICTIONS
LEGIBILITY

FLYABILITY CHECK
IDENTIFY SPECIFIC AREAS OF CONCERN

MISCELLANEOUS
PROXIMITY TO SPECIAL USE AIRSPACE

INSTRUMENT PROCEDURE FLYABILITY CHECK

A9.1. Instrument procedure flyability checks are flown to ensure procedures are safe, practical, and consistent with good operating procedures. Flyability checks are NOT official flight inspections ("flight checks"), but shall include the entire procedure including the missed approach segment and all holding patterns.
NOTE 1: When conducting flyability checks at Host Nation airfields, it may be difficult to evaluate the entire procedure. For portions of the IAP that cannot be flown, pilots will visually evaluate the probability of satisfactory NAVAID/Radio reception, obstacle and terrain clearance, e.g., If the missed approach segment cannot be flown on arrival, an assessment can be made when departing, if practical.
NOTE 2: The MAJCOM Director of Operations may waive the requirement for a flyability check at host nation airfields in one or both of the following situations:

- The airfield is located in a country identified with an asterisk (*) on the HQ AFFSA Host Nation Acceptance List.
- The airfield is routinely served by a U.S. FAR Part 121 air carrier (Every effort should be made to contact the appropriate U.S. Operator to determine if special restrictions have been established for operating at this airport. If restrictions have been established by the air carrier, the MAJCOM will evaluate whether these restrictions should be applied).

NOTE 3: If the flyability check is waived by the MAJCOM Director of Operations or a portion of the procedure could not be flown, a flight simulator or “table top” review shall be accomplished and documented on AF Form 3992, ***Instrument Procedure Flyability Check, Instrument Approach Procedure (IAP)*** or AF Form 3993, ***Instrument Procedure Flyability Check, Standard Instrument Departure,*** which ever is appropriate. These forms shall be maintained with the TERPS procedure package.

A9.2. All flyability checks should determine whether the procedure is flyable and safe for a minimally qualified, solo pilot flying an aircraft equipped with basic IFR instrumentation under Instrument Meteorological Conditions (IMC) - could a low time lieutenant flying a single seat fighter in bad weather safely fly the approach?

A9.3. Flyability checks will be flown under visual meteorological conditions (VMC). While conducting the flyability check, the crew must be vigilant for obstructions, especially those not depicted that could be hazardous. Final approach course alignment ("desired aiming point") should also be looked at carefully - you should be able to safely maneuver from the missed approach point to touchdown.

A9.4. Consider the following human factors carefully:
A9.4.1. **Complexity.** The procedure should be as simple as possible. It should not impose excessive work load.
A9.4.2. **Interpretability.** The NAVAID which provides information for the final approach course should be clearly identifiable. Be careful, NAVAIDs located on or near the final approach course, but that are not part of the final approach segment, are often subject to misinterpretation. The depicted procedure should clearly indicate to which runway(s) a circling approach can be made, and what areas, if any, cannot be used during the circling maneuver.
A9.4.3. **Memory Considerations.** An aeronautical chart is a storehouse of information. A pilot must be able to extract information quickly and accurately, so evaluate whether essential data can be quickly and easily found and deciphered.

A9.5. Flyability check forms should be reviewed before the flyability check is flown. Complete the flyability check (See examples at figures A9.1 or A9.2) and sign it. Any comments should be written in the remarks section. Whenever possible, the pilot should personally debrief the TERPS specialist responsible for the procedure. Remember, recommendations are always welcome.

Figure A9.1. Sample AF Form 3992, Instrument Procedure Flyability Check Form (IAP).

INSTRUMENT PROCEDURE FLYABILITY CHECK
INSTRUMENT APPROACH PROCEDURE (IAP)

LOCATION Bedrock AFB, LA	DATE CHECK FLOWN 7 Dec 1996
NAME OF PROCEDURE TACAN or ILS/DME Rwy 36R	TYPE AIRCRAFT C-17

METHOD *(Check one)*

X	LIVE *(Actually Flown)*		SIMULATOR		TABLE TOP REVIEW ONLY

NOTE: PLEASE REFER TO AFMAN 11-230, ATTACHMENT 9, PARAGRAPHS A9.1 THROUGH A9.5 FOR GUIDANCE/METHODS TO BE FOLLOWED BEFORE CONDUCTING THIS FLYABILITY CHECK.

SEGMENTS NOT FLOWN OR CHECKED SHALL BE ANNOTATED "NF" IN THE "REMARKS" COLUMN. ITEMS THAT ARE NOT APPLICABLE SHOULD BE MARKED "NA". EACH MUST BE MARKED OR ANNOTATED.

1. INITIAL APPROACH FIX (IAF) HOLDING PATTERN. TERPS SPECIALIST COMMENTS/CONCERNS *(Continue on separate sheet of paper)*:

Holding Pattern designed to accommodate speeds up to 310 KIAS. If possible, evaluate holding pattern at this speed.

INITIAL APPROACH FIX *(IAF)* HOLDING PATTERN	SAT	UN SAT	REMARKS	INITIAL APPROACH FIX *(IAF)* HOLDING PATTERN	SAT	UN SAT	REMARKS
A. ENTRY	X			D. MANEUVERING	X		
B. LEG LENGTH	X			E. SPEED RESTRICTIONS	X		Flown at 300 KIAS
C. NAVAID RECEPTION	X			F. ATC COMMUNICATIONS	X		

2. IAF TO FINAL APPROACH FIX (FAF). TERPS SPECIALIST COMMENTS/CONCERNS *(Continue on separate sheet of paper)*:

Intermediate segment is 5 NM. Please determine if this segment length is sufficient in length to configure aircraft after turning on from 15 DME arc.

IAF TO FINAL APPROACH FIX *(FAF)*	SAT	UN SAT	REMARKS	IAF TO FINAL APPROACH FIX *(FAF)*	SAT	UN SAT	REMARKS
A. CHARTED COURSES/ARCS/ RADIALS, ETC.	X			E. COCKPIT WORKLOAD	X		
B. ALTITUDES	X			F. NAVAID RECEPTION	X		
C. ALTITUDES AIRCRAFT MANEUVERING ALTITUDES	X			G. ATC COMMUNICATIONS	X		
D. TIME/DISTANCE TO PRE-PARE FOR FAF	X		No problems	H. DESCENT GRADIENT	X		150 ft/NM Excellent!

3. FAF TO MISSED APPROACH POINT (MAP). TERPS SPECIALIST COMMENTS/CONCERNS *(Continue on separate sheet of paper)*:

TACAN and Localizer Missed Approach Point moved from .8 DME to .5 DME.
VDP changed to 1.1 DME due to new installation of PAPI system.

FAF TO MISSED APPROACH POINT (MAP)	SAT	UN SAT	REMARKS
A. OBSTACLE CLEARANCE	X		
B. FINAL APPROACH COURSE ALIGNMENT			
C. AIRCRAFT MANEUVERING	X		
D. VISUAL DESCENT POINT (VDP)	X		
E. MAP LOCATION	X		New location works fine.
F. COCKPIT WORKLOAD	X		
G. DESCENT GRADIENT	X		
H. NAVAID RECEPTION	X		
I. APPROACH LIGHTS		X	Trees/shrubs growing up through approach lights (See Block #6)
J. LANDING MINIMUMS	X		
K. ATC COMMUNICATIONS	X		

AF FORM 3992, DEC 96 ***(EF-V1)*** *(PerFORM PRO)*

Figure A9.1. Continued.

4. MISSED APPROACH *(NOTE: Missed approach should be flown at approximately 160 FPNM (450 Ft/Min VVI at 180 KIAS) or at missed approach climb tablle gradient, whichever is greater. Vigiliance for obstruction is critical.)* TERPS SPECIALIST COMMENTS/CONCERNS:

Procedure requires a missed approach climb gradient of 250 ft/NM due to 1998' (MSL) antenna located approximately 3.5 NM from departure end of runway.

MISSED APPROACH	SAT	UN SAT	REMARKS	MISSED APPROACH	SAT	UN SAT	REMARKS
A. UNDERSTANDABLE	X			E. COCKPIT WORKLOAD	X		
B. AIRCRAFT MANEUVERING	X			F. ATC COMMUNICATIONS	X		
C. OBSTACLE CLEARANCE	X			G. CLIMB GRADIENT	X		No problems
D. NAVAID RECEIPTION	X						

5. CIRCLING AREAS. (NOTE: If the circling maneuvering is not flown ("N/F") make comments as to the safeness of the circling area. For approaches with CAT D, minimums, look for obstacles within 3 NM of the runway in all directions. For approaches with CAT E minimums, look for obstacles within 5 NM of the runway in all directions. The location and estimated height of questionable obstacles should be noted in the remarks section of this checklist.) TERPS SPECIALIST COMMENTS/CONCERNS:

Please evaluate to CAT E Circling area, paying close attention to 1998' obstacle (antenna) approximately 3.5 NM off departure end of Rwy 36R.

CIRCLING AREAS	SAT	UN SAT	REMARKS
A. AIRCRAFT MANEUVERING	X		See comments below.
B. OBSTACLE CLEARANCE	X		See comments below.
C. ABSENCE OF OPTICAL ILLUSIONS	X		See comments below.
D. ATC COMMUNICATIONS	X		

6. ADDITIONAL COMMENTS:

Paragraph 3I: Trees/shrubs are growing up through the first line of approach lighting bars on approach, obscuring the lights.

Paragraph 5A, 5B & 5C: CAT E Circling area was flown and evaluated. We conducted this check during daylight hours, however, the 1998' antenna located in the CAT E circling area could be hazardous during the hours of darkness. The antenna contains the appropriate red lighting, however it may blend in with other ground lighting and difficult to acquire when performing the circling maneuver. I recommend that this circling area be evaluated at night or consider CAT E circling not be authorized in that quadrant.

I CONSIDER THE ABOVE SPECIFIED INSTRUMENT PROCEDURE AS FLYABLE AND SATISFACTORY.

SIGNATURE		DATE
Bartholomew H. Simpson		7 Dec 1996
PRINT/TYPE NAME AND RANK	UNIT AND MAJCOM	DUTY PHONE *(DSN/Commerical)*
Bartholomew H. Simpson, Major, USAF	123 AW AMC	DSN 777-6789

AF FORM 3992, DEC 96 *(EF-V1) (PerFORM PRO)*

Figure A9.2. Sample AF Form 3993, Instrument Procedure Flyability Check Form (SID).

INSTRUMENT PROCEDURE FLYABILITY CHECK
STANDARD INSTRUMENT DEPARTURE (SID)

LOCATION	ICAO IDENTIFICATION
Bedrock AFB, LA	KBDR

NAME OF PROCEDURE
BEDROCK 1 Departure

TYPE AIRCRAFT	PILOT
C-17	Maj. Bart Simpson

METHOD

X	LIVE *(Actually flown)*		SIMULATOR		TABLE TOP REVIEW ONLY

TERPS SPECIALIST COMMENTS

Please evaluate the 420 foot per NM climb gradient for acceptability. This climb gradient is required to provide the appropriate obstacle clearance over a 1998' (MSL) antenna located 3.5 NM from the Departure End of Runway (DER), approximately 1/4 NM East of proposed ground track.

NOTE: Departures are to be flown at 200 feet per Nautical Mile (i.e., 600 Ft/Min. VVI at 180 KIAS) or at the published Rate of Climb as indicated in a Climb Table, whichever is greater. Vigilance for obstructions that could be unsafe is critical. Areas not checked/flown should be annotated "NF" in the remarks section

SAT	UNSAT		REMARKS
X		AIRCRAFT MANEUVERING	SEE REMARKS BELOW
X		ALTITUDE RESTRICTIONS	Acceptable.
X		NAVAID RECEPTION	No problems noted.
X		COCKPIT WORKLOAD	Acceptable.
X		OBSTACLE CLEARANCE	
X		EASY TO UNDERSTAND	Procedure is very simple and text is easily understood.

FLYABILITY CHECK PILOT COMMENTS

Climb gradient (CG) of 420 feet per NM was found to be acceptable for our particular mission profile, however, it must be noted that this CG may be unacceptable for certain aircraft operating at or near gross weight. Consideration should be given to altering the departure course to the West, if possible, to avoid the obstacle and reduce the climb gradient.

I CONSIDER THE ABOVE SPECIFIED INSTRUMENT PROCEDURE AS FLYABLE IAW THIS CHECKLIST

SIGNATURE		DATE
Bartholomew H. Simpson		7 Dec 1996
PRINTED/TYPED NAME AND RANK	DUTY PHONE *(DSN/COMMERCIAL)*	UNIT/MAJCOM
Bartholomew H. Simpson, Major, USAF	DSN 777-6789	123 AW AMC

AF FORM 3993, DEC 96 ***(EF-V1)*** *(PerFORM PRO)*

HORIZONTAL DATUM CODES

1 WGS 1972	Global Definition WGS 72
2 Adindan	MEAN FOR Ethiopia, Sudan Clarke 1880
3 Adindan	Burkina Faso Clarke 1880
4 Adindan	Cameroon Clarke 1880
5 Adindan	Ethiopia Clarke 1880
6 Adindan	Mali Clarke 1880
7 Adindan	Senegal Clarke 1880
8 Adindan	Sudan Clarke 1880
9 Afgooye	Somalia Krassovsky
10 Ain el Abd 1970	Bahrain International
11 Ain el Abd 1970	Saudi Arabia International
12 Anna 1 Astro 1965	Cocos Islands Australian National
13 Antigua Island Astro 1943	Antigua (Leeward Islands) Clarke 1880
14 Arc 1950	MEAN FOR Botswana, Lesotho, Malawi, Clarke 1880
15 Arc 1950	Swaziland, Zaire, Zambia, Zimbabwe Clarke 1880
16 Arc 1950	Botswana Clarke 1880
17 Arc 1950	Burundi Clarke 1880
18 Arc 1950	Lesotho Clarke 1880
19 Arc 1950	Malawi Clarke 1880
20 Arc 1950	Swaziland Clarke 1880
21 Arc 1950	Zaire Clarke 1880
22 Arc 1950	Zambia Clarke 1880
23 Arc 1950	Zimbabwe Clarke 1880
24 Arc 1960	MEAN FOR Kenya, Tanzania Clarke 1880
25 Ascension Island 1958	Ascension Island International
26 Astro Beacon E 1945	Iwo Jima International
27 Astro DOS 71/4	St Helena Island International
28 Astro Tern Island (FRIG) 1961	Tern Island International
29 Astronomical Station	Marcus Island International
30 Australian Geodetic 1966	Australia & Tasmania Australian National
31 Australian Geodetic 1984	Australia & Tasmania Australian National
32 Ayabelle Lighthouse	Djibouti Clarke 1880
33 Bellevue	(IGN) Efate & Erromango Islands International
34 Bermuda 1957	Bermuda Clarke 1866
35 Bissau	Guinea-Bissau International
36 Bogota Observatory	Colombia International
37 Bukit Rimpah Indonesia	(Bangka & Belitung Islands) Bessel 1841
38 Camp Area Astro Antarctica	(McMurdo Camp Area) International
39 Campo Inchauspe	Argentina International
40 Canton Astro 1966	Phoenix Islands International
41 Cape South Africa	Clarke 1880
42 Cape Canaveral Bahamas,	Florida Clarke 1866
43 Carthage	Tunisia Clarke 1880
44 Chatham Island Astro 1971	New Zealand (Chatham Island) International
45 Chua Astro	Paraguay International
46 Corrego Alegre	Brazil International
47 Dabola	Guinea Clarke 1880
48 Djakarta	(Batavia) Indonesia (Sumatra) Bessel 1841
49 DOS 1968	New Georgia Islands (Gizo Island) International
50 Easter Island 1967	Easter Island International
51 European 1950	MEAN FOR Austria, Belgium, Denmark, Finland, International
52 European 1950	France, W Germany, Gibraltar, Greece, International
53 European 1950	Italy, Luxembourg, Netherlands, Norway, International
54 European 1950	Portugal, Spain, Sweden, Switzerland, International
55 European 1950	MEAN FOR Austria, Denmark, France, International

56 European 1950	W Germany, Netherlands, Switzerland, International
57 European 1950	MEAN FOR Iraq, Israel, Jordan, Lebanon, International
58 European 1950	Kuwait, Saudi Arabia, Syria International
59 European 1950	Cyprus International
60 European 1950	Egypt International
61 European 1950	England, Channel Islands, Ireland, International
62 European 1950	Scotland, Shetland Islands International
63 European 1950	Finland, Norway International
64 European 1950	Greece International
65 European 1950	Iran International
66 European	Italy (Sardinia) International
67 European 1950	Italy (Sicily) International
68 European 1950	Malta International
69 European 1950	Portugal, Spain International
70 European 1979	MEAN FOR Austria, Finland, Netherlands, International
71 European 1979	Norway, Spain, Sweden, Switzerland International
72 Fort Thomas 1955	Nevis, St. Kitts (Leeward Islands) Clarke 1880
73 Gan 1970	Republic of Maldives International
74 Geodetic Datum 1949	New Zealand International
75 Graciosa Base SW 1948	Azores (Faial, Graciosa, Pico, International
76 Graciosa Base SW 1948	Sao Jorge, Terceira) International
77 Guam 1963	Guam Clarke 1866
78 Gunung Segara	Indonesia (Kalimantan) Bessel 1841
79 GUX 1 Astro	Guadalcanal Island International
80 Herat North	Afghanistan International
81 Hjorsey 1955	Iceland International
82 Hong Kong 1963	Hong Kong International
83 Hu-Tzu-Shan	Taiwan International
84 Indian	Bangladesh Everest 1830
85 Indian	India, Nepal Everest 1956
86 Indian 1954	Thailand, Vietnam Everest 1830
87 Indian 1975	Thailand Everest 1830
88 Ireland 1965	Ireland Modified Airy
89 ISTS 061 Asto 1968	South Georgia Islands International
90 ISTS 073 Astro 1969	Diego Garcia International
91 Johnston Island 1961	Johnston Island International
92 Kandawala	Sri Lanka Everest 1830
93 Kerguelen Island 1949	Kerguelen Island International
94 Kertau 1948	West Malaysia & Singapore Everest 1948
95 Kusaie Astro 1951	Caroline Islands International
96 L. C. 5 Astro 1961	Cayman Brac Island Clarke 1866
97 Leigon	Ghana Clarke 1880
98 Liberia 1964	Liberia Clarke 1880
99 Luzon Philippines	(Excluding Mindanao) Clarke 1866
100 Luzon Philippines	(Mindanao) Clarke 1866
101 Mahe 1971	Mahe Island Clarke 1880
102 Massawa	Ethiopia (Eritrea) Bessel 1841
103 Merchich	Morocco Clarke 1880
104 Midway Astro 1961	Midway Islands International
105 Minna	Cameroon Clarke 1880
106 Minna	Nigeria Clarke 1880
107 Montserrat Island Astro 1958	Montserrat (Leeward Islands) Clarke 1880
108 M'Poraloko	Gabon Clarke 1880
109 Nahrwan	Oman (Masirah Island) Clarke 1880
110 Nahrwan	Saudi Arabia Clarke 1880
111 Nahrwan	United Arab Emirates Clarke 1880

112 Naparima BWI	Trinidad & Tobago International
113 Observatorio Metereo. 1939	Azores (Corvo & Flores Islands) International
114 Old Egyptian 1907	Egypt Helmert 1906
115 Old Hawaiian	MEAN FOR Hawaii, Kauai, Maui, Oahu Clarke 1866
116 Old Hawaiian	Hawaii Clarke 1866
117 Old Hawaiian	Kauai Clarke 1866
118 Old Hawaiian	Maui Clarke 1866
119 Old Hawaiian	Oahu Clarke 1866
120 Oman	Oman Clarke 1880
121 Ord. Survey G. Britain 1936	MEAN FOR England, Isle of Man, Scotland, Airy
122 Ord. Survey G. Britain 1936	Shetland Islands, Wales Airy
123 Ord. Survey G. Britain 1936	England Airy
124 Ord. Survey G. Britain 1936	England, Isle of Man, Wales Airy
125 Ord. Survey G. Britain 1936	Scotland, Shetland Islands Airy
126 Ord. Survey G. Britain 1936	Wales Airy
127 Pico de las Nieves	Canary Islands International
128 Pitcairn Astro 1967	Pitcairn Island International
129 Point 58	MEAN FOR Burkina Faso & Niger Clarke 1880
130 Pointe Noire 1948	Congo Clarke 1880
131 Porto Santo 1936	Porto Santo, Madeira Islands International
132 Provisional S. American 1956	MEAN FOR Bolivia, Chile, Colombia, International
133 Provisional S. American 1956	Ecuador, Guyana, Peru, Venezuela, International
134 Provisional S. American 1956	Bolivia International
135 Provisional S. American 1956	Chile (Northern, Near 19°S) International
136 Provisional S. American 1956	Chile (Southern, Near 43°S) International
137 Provisional S. American 1956	Colombia International
138 Provisional S. American 1956	Ecuador International
139 Provisional S. American 1956	Guyana International
140 Provisional S. American 1956	Peru International
141 Provisional S. American 1956	Venezuela International
142 Provisional S. Chilean 1963	Chile (South, Near 53°S) (Hito XVIII) International
143 Puerto Rico	Puerto Rico, Virgin Islands Clarke 1866
144 Qatar National	Qatar International
145 Qornoq	Greenland (South) International
146 Reunion	Mascarene Islands International
147 Rome 1940	Italy (Sardinia) International
148 Santo (DOS) 1965	Espirito Santo Island International
149 Sao Braz	Azores (Sao Miguel, Santa Maria Islands) International
150 Sapper Hill 1943	East Falkland Island International
151 Schwarzeck	Namibia Bessel 1841 (Namibia)
152 Selvagem Grande	Salvage Islands International
153 SGS 85	Soviet Geodetic System 1985 SGS 85
154 South American 1969	MEAN FOR Argentina, Bolivia, Brazil, Chile, South American 1969
155 South American 1969	Colombia, Ecuador, Guyana, Paraguay, South American 1969
156 South American 1969	Peru, Trinidad & Tobago, Venezuela South American 1969
157 South American 1969	Argentina South American 1969
158 South American 1969	Bolivia South American 1969
159 South American 1969	Brazil South American 1969
160 South American 1969	Chile South American 1969
161 South American 1969	Colombia South American 1969
162 South American 1969	Ecuador South American 1969
163 South American 1969	Ecuador (Baltra, Galapagos) South American 1969
164 South American 1969	Guyana South American 1969
165 South American 1969	Paraguay South American 1969

166	South American 1969	Peru South American 1969
167	South American 1969	Trinidad & Tobago South American 1969
168	South American 1969	Venezuela South American 1969
169	South Asia	Singapore Modified Fischer 1960
170	Tananarive Observatory 1925	Madagascar International
171	Timbalai 1948	Brunei, East Malaysia (Sabah, Sarawak) Everest (Sabah Sarawak)
172	Tokyo	MEAN FOR Japan, Korea, Okinawa Bessel 1841
173	Tokyo	Japan Bessel 1841
174	Tokyo	Korea Bessel 1841
175	Tokyo	Okinawa Bessel 1841
176	Tristan Astro 1968	Tristan da Cunha International
177	Viti Levu 1916	Fiji (Viti Levu Island) Clarke 1880
178	Wake-Eniwetok 1960	Marshall Islands Hough
179	Wake Island Astro 1952	Wake Atoll International
180	Yacare	Uruguay International
181	Zanderij	Suriname International
182	WGS 1984	Global Definition WGS 84
183	North American Datum 1927	NAD 27
184	North American Datum 1980	NAD 83
999	Other DATUM codes	